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Socioeconomic determinants of life expectancy in post-apartheid South Africa

by

Uviwe Binase

3358089

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Supervisor: Dr. Kanayo Ogujiuba

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DECLARATION

I declare that ***socioeconomic determinants of life expectancy in post-apartheid South Africa*** is my own work, that it has not been submitted for any degree or examination in any institution, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Signature:

Date: November 2018

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Abstract

Life expectancy in South African has been fluctuating following the global trends that affects both developed and developing countries. In South Africa the average life expectancy from 1994 to 1996 was higher with an average of 61,3 years. As from 1997 to 1999 it declined to an average of 58,4 years. The difference in years between 1994-1996 and 1997- 1999 was 2,9 years. From 2000-2002, life expectancy continued to decline to an average of 54,6 years. Life expectancy declined in a constant proportion from 2003-2005 and 2006-2008. In 2003-2005 it slightly declined to 52 years and in 2004-2007 it declined to 42,0 years. Life expectancy escalated after the mentioned years to 54,4 years between 2009-2011 and from 2012-2013 life expectancy was 54,0 years on average. This study examined factors or variables that verify the socioeconomic determinants of life expectancy in post-apartheid South Africa. Understanding the relationship between life expectancy and the socioeconomic variables was based on three objectives. The main objective for this study was to determine the impact of socioeconomic variables and health policy efforts on life expectancy, seeking an in-depth understanding by investigating the causality relationship between life expectancy and socioeconomic variables thus later investigating the difference between male and female's life expectancy.

This study was motivated by the fluctuating life expectancy in South Africa. The fluctuation in life expectancy were thus studied in relation to socioeconomic determinants which are government health expenditure, government education expenditure, GDP per capita, total fertility rate, urban population, access to sustainable drinking water and undernourishment. The mentioned variables were used as socioeconomic determinants of life expectancy during post-apartheid South Africa.

Data from the World Bank was used. Econometric models such as the vector error correction model (VECM), vector autoregressive (VAR), Granger causality and the independent t-test were used as the main results for estimation. The Augmented dicker-fuller and Johansen co-integration test were used as preliminary results for the above-mentioned test with Wald test, LM test, Stability diagnostics and normality test used as the confirmatory test results.

It is evident that the socioeconomic variables have both along and short run relationship with life expectancy. Variables under study were stationary under the inverse root test and unit root test. A percentage change in government education expenditure, per capita GDP and access to sustainable water was associated with a percentage increase in life expectancy have an impact to life expectancy. Access to sustainable water, prevalence to undernourishment and total fertility rate showcased a granger causal relationship with life expectancy. Life expectancy and prevalence to undernourishment have a bidirectional causal relationship. From the results it was evident that a bidirectional relationship occurred for most variables with a unidirectional flow occurring for some of the variables. An access to sustainable water does not granger cause life expectancy whereas life expectancy was indicated to granger cause an access to sustainable water. The total fertility rate granger caused life expectancy and life expectancy had no causal relationship with total fertility rate. A bi-directional relationship was evident between life expectancy and undernourishment, these variables granger caused each other. The socioeconomic determinants of life expectancy led the study to concluding that females tend to have a higher life expectancy than that of males.

Keywords: *error-correction model, causality, cointegration model, health policy, human immune deficiency virus*

Contents

Abbreviations and Acronyms

ADF	- Augmented Dicker Fuller
AIDS	- Acquired Immune Deficiency Syndrome
AIC	- Akaike Information Criterion
ART	- Antiretroviral drugs
ASFR	- Age Specific Fertility Rate
ASPR	- Age Specific Prevalence Rate
DFLGS	- Dickey-Fuller Test with GLS Detrending
DNR	- Do Not Reject
E-Views	- Econometric Views
ERS	- Elliot, Rothenberg, and Stock Point Optimal
KPSS	- Kwiatkowski, Phillips, Schmidt, and Shin
LEDUA	- Log of Expenditure on Education
LLIFE	- Log of Life Expectancy
LGDP	- Log of Gross Domestic Product
LIWS	- Log of Access to Sustainable Drinking Water
LPCHE	- Log of Health Expenditure Per Capita
LTFR	- Log of Total Fertility Rate
LUNOUR	- Log of Prevalence of undernourishment
LURBAN	- Log of Urban Population
GDP	- Gross Domestic Product
GNP	- Gross National Product
HIV	- Human Immunodeficiency Virus

IMR	- Infant Mortality Rate
MDGs	- Millennium Development Goals
MTEF	- Medium Term Expenditure Framework
NDP	- National Development Plan
NP	- Ng and Perron
PP	- Phillips Perron
PPR	- Parity Progression Ratio
SA	- South Africa
SDG’s	- Sustainable Development Goals
SED	- Socioeconomic Determinants
StatsSA	- Statistics South African
SPSS	- Statistical Package for the Social Sciences
TFR	- Total Fertility Rate
UN	- United Nations
UNDP	- United Nations Development Plan
UNESCO	- United Nation Education and Scientific Organization
UNICEF	- United Nations International Children’s Emergency Fund
VAR	- Vector Autoregressive
VEC	- Vector Error Correction
VECM	- Vector Error Correction Model
WHO	- World Health Organization

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CHAPTER ONE: Introduction

1.1Background

During the past decades life expectancy at birth was identified as a prominent indicator that identifies whether a country is a developed or a developing country (Shahbaz *et al*., 2015). This was because economic growth had a substantial consequence on the growth of an individual's expected life even though this might differ in countries. The above statement provides a clear understanding of how countries more specifically developing countries empower the economy through investing in socioeconomic development like an individual's education, environmental management, hygiene, health and other social security resources. Life expectancy can also be defined as an average number of years a person is expected to live. Kinsella and Ferreira (2007) define life expectancy as a tool that measures how an individual on average is expected to live; based on the individual's year of birth, present age and other demographic factors including gender. A higher life expectancy is an indicator of the better standard of living in a country; this has been shown by a direct link that occurs when there is development in a country's social services, health and economic development (Lomborg, 2002). Japan had an expected life of 83,1 in 2012 and increased to 83, 3 years in 2013 and 83,6 years in 2014 which was higher than Sierra Leone with an expected life of 49, 8 in 2012, an average life expectancy of 50,4 years in 2012 and an average of 51,0 years in 2014. Both these countries had a slight increase in life expectancy between the year 2012 and 2014 which is an indication of the level of development in both countries.

Life expectancy is often used and studied in the composition of demographic data when collecting mortality experiences and it is also used for a reliable comparison between countries. In the past ten years around the world, the expected life showed accumulative inclination although its speed for increment varied from country to country. Improved working and living arrangements, as well as motherly care, a rise in educated people and an increasing per capita income has directed to an upsurge in life expectancy. The scenario is slightly different in South Africa, as the life expectancy is fluctuating due to socio-dynamics including but not limited to the socioeconomic variables. The expected life of individuals can be used as an assessing tool as it measures a country's health and wellness which are likely to be affected by socioeconomic and environmental factors. South Africa does not have information relating life expectancy to socioeconomic variables of its citizens. Thus, the base of this research is to evaluate the socioeconomic determinants of life expectancy during the post-apartheid South Africa.

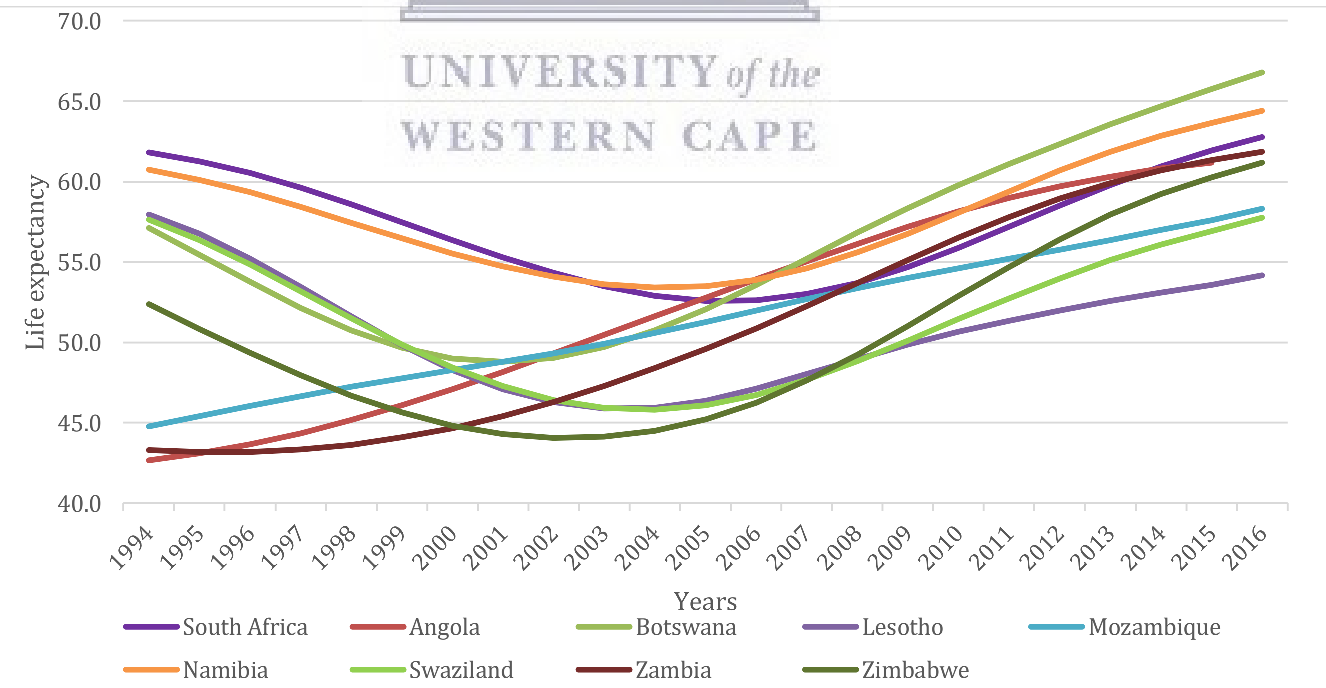
An analysis for life expectancy using socioeconomic variables as determiners for a decline and growth in life expectancy has reported a clear gradient. People from wealthy households with parents classified as higher managers and other professions like doctors and lawyers could be expected to have a higher level of life expectancy of 5,8 years longer than those people with parents who have custom professions such as laborers and cleaners (ONS, 2011). The structure of expenditures has changed in developed countries due to the change in income per capita which resulted in a reduction in undernourishment, high adult literacy rate, improved hygiene and access to purified drinking water; these changes in expenditure contribute towards an increase in life expectancy. In developing countries situated in Africa, this is not the case as the preponderance of the African countries face a declining rate in life expectancy although they have enhanced their economy as well as their health expenditures. Life expectancy in developed countries correlates with post-apartheid years as developments in their health system tends to be inclined with life expectancy. Japan had an expected life of 83,6 years in 2014 which was higher than Sierra Leone with an expected life of 51,0 years in 2014.

The development in life expectancy is a significant subject to consider in demographic studies. The population trends in growth for Pakistan between the year 2011 and 2012 show that in 2012 the population size was 179, 2 million with a fertility rate of 3, 34 births per women in 2011. Females had a higher life expectancy in Pakistan than men in 2012, with a female life expectancy of 68, 28 years and 64, 52 years for males. The average life expectancy the following year in Pakistan was 65, 7 years, influenced by the 2011 fertility rate and the annual growth. The population was 154, 7 million during the year 2013 in Bangladesh with births per women 2, 20 less than that of Pakistan with a population growth of 1, 2% which was also less than the population growth of 1,7% in Pakistan. Bangladesh's gender variance in the expected life was higher than the life expectancy between these two genders in Pakistan, males in Pakistan had a relative expected life of 68,48 years even more than the life expectancy for females in Pakistan which was 68,28 and females in Bangladesh with a life expectancy of 72,31 years in 2011.

In India the population was 1,237 billion in 2012 with a fertility rate of 2,59 in 2011.The gender differences in life expectancy of India is under a similar bracket with Pakistan even though the years they are expected to live differ slightly, females in India had a life expectancy of 68,33 years and males had a life expectancy of 66,04 years in 2012 with an average life expectancy of 65,8 years in 2013.It is evident from the above figures that even though India had a highest population size their fertility rate was less than the fertility rate of Pakistan and India had a higher life expectancy compared to Pakistan regardless of their population size during the afore mentioned cohorts. Bangladesh has a smaller number of population size between the three countries and had the highest life expectancy. This indicates that a country can have a higher population size and still find means for developing the expected years of survival through implementing ways into which an economy for that country can sustain their population.

In 2010 and 2011 in USA only 2,3 million people was added to their population size a decline in size when comparing it with the 2,9 million people from 2005 to 2006 (Mather, 2012). The decline in population size was indicated to be due to the declining levels of immigration, lower population that is aging and a lower fertility rate. Bacon (2016) stipulates that in the USA life expectancy bent down in a month in 2014 to 78, 8 years. The culprits for their declining years were amplifications in mortality caused by chronic ailments and suicides. These chronic ailments including cancer and flu are said to form part of the most 10 causes of mortality in United States of America. Bacon (2016) also highlighted that 3% increase in mortality was due to "unintentional injuries." This includes, among other things, road traffic accidents and drug overindulgences, both of which often involve comparatively youthful victims whose deaths can have a sturdy impact on the numbers.

Figure 1,1: Southern African countries life expectancy



Source: data source from The World Bank

From the above figure 1, 1 it is evident from the Southern African life expectancy that Botswana has the highest life expectancy of 66, 8 years and Lesotho has the lowest life expectancy of 54, 2 years in 2016. Bangladesh's life expectancy in 2011 was 72, 31 years and Pakistan had a life expectancy of 65, 7 years the same year. The average life expectancy for both these countries was not comparable to the Southern African countries as their life expectancy was higher. The Southern African country with the highest life expectancy in 2011 was Botswana with an average life expectancy of 61, 1 year. South Africa had an expected year of 61, 8 years in 1994 and Namibia had a life expectancy of 60, 1 years. Mozambique's life expectancy has been increasing linearly from 1994 to 2016; the similar trend is evident in Zambia. The proportion into which life expectancy has increased for other Southern African countries from 1994 to 2016 is U-shaped.

The disparities among countries can be clarified by long-term developments in socioeconomic, environmental, and health factors. The disparity between developed and developing countries is a concern to health policy makers, an evaluation of how these leading socioeconomic factors influence life expectancy forms part of the health policy makers investigation. Sede and Ohemeng (2015) indicated its most prominent socioeconomic variables by stating that per capita income, number of years at school and government health expenditures are the main socio-economic factors distressing life expectancy in Nigeria. In support of this, Gulis (2000) has inspected the main causes of fluctuation in life expectancy for 156 developed and developing countries and came to conclusion that the variables under study which are education, GDP per capita, access to sustainable water, undernourishment have a significant effect on life expectancy. Gulis (2000) indicated that income per capita, public health expenditure, sustainable drinking water, calorie intake, and literacy were the main determinants of life expectancy.

Socioeconomic factors have a very sturdy impact on life expectancy as an increase in inflation decreases the household's power for purchasing consequently in the long run the life expectancy of households turn out to be impacted negatively. Statistics South Africa (2018b) specified that the youth unemployment in South Africa was still high on the first quarter of 2018. This unemployment rate of 26,7% remained unbothered over the first quarter of 2018 when comparing it to the fourth quarter of 2017. Being unemployed influences life expectancy as occupation influences life expectancy and individual expected year of survival differ according to the area of occupation. Unemployment has a direct link with undernourishment as means of survival become limited for unemployed people as they cannot afford to purchase certain resources, thus unemployment reduces life expectancy. Crimmins *et al*., (2016) detailed that the biggest issue individuals are challenged with is their disability. This author further stipulates that even though life expectancy is higher for certain individuals, disabled people do not enjoy more years of life as able individuals; sickness paves its way in between the years until death occurs. In explaining this, male's expected years of life amplified by 4,7 years and women had a life expectancy of 5,1 years, but the years which can be indicated as the years of good health were 3,9 years, which indicates that the larger amount of the lives are affected by illness and disability compared to the previous years (Crimmins *et al*., 2016). This means that people spend almost half of their lives facing sicknesses. Disability in health occurs as a result of the sicknesses that affect people during their working age. South Africa's retirement age is varying from 55 to 65 years, but most people become ill even before they reach their retirement age thus the statement above suggested that disabled people do not enjoy more years of life as able people.

In South Africa, the average life expectancy is slightly decreasing, between 2009 – 2011 South African life expectancy was 54,4 years and between 2012 – 2013 life expectancy dropped slightly to 54,0 years. The Mail Online (2018) states that from the 195 countries that were ranked in the health journal projections for life expectancy, South Africa was ranked the 171 country in 2016 with an average life expectancy of 62,43 years. For the year 2040, South African life expectancy has been projected to increase slightly with an average of 69,33 years. In 2040 it has been estimated that most countries at Southern Europe will have the highest life expectancy. Southern African countries will remain with the lowest expected life span (Mail Online, 2018). With the rapid development of modern life, average longevity seems to be decreasing. Fluctuation in life expectancy has been an issue even before 1994 but in this research, the focus will be from the year 1994 until 2016. According to Health24 (2015), the average years of life people are expected to live have dropped drastically in South Africa, from 64 years in 1994 to 49 years in 2001.During the post-apartheid South Africa, there has been a fluctuation in life expectancy (see figure 1, 2), from 1994 to 1996 life expectancy was higher with an average of 61,3 years. As from 1997 to 1999 it declined to an average of 58,4 years. The difference in years between 1994-1996 and 1997- 1999 was 2,9 years. From 2000-2002, life expectancy continued to decline to an average of 54,6 years. Life expectancy declined in a constant proportion from 2003-2005 and 2006-2008. In 2003-2005 it slightly declined to 52 years and in 2004-2007 it declined to 42,0 years. Life expectancy escalated after the mentioned years to 54,4 years between 2009-2011 and from 2012-2013 life expectancy was 54,0 years on average.

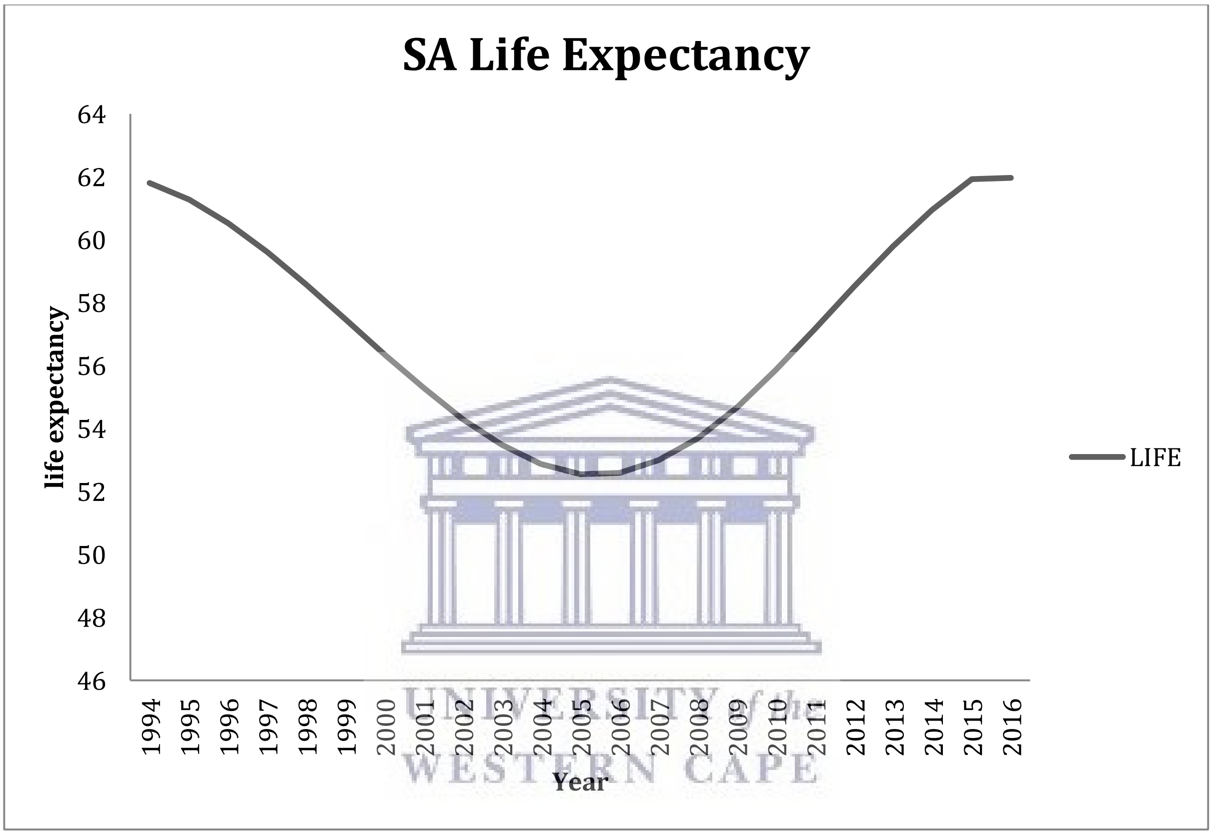
It is evident from figure 1,2 that there was a decline in life expectancy between the year 1995 to 2005, a stable growth between the year 2003 and 2007 and an increase the year after. This most rigorous fall was during the catastrophe of an HIV and Aids epidemic. An increase in life expectancy is mostly significant from the year 2005, during the period where ARV's were made available to patients from hospitals and clinics. The decline in life expectancy from the year 1995 indicates the level into which South Africa was after apartheid. There was no stable growth and the life expectancy was 52 years. This would therefore mean that the economy was at stake during these years as the individuals working age was below 52 years meaning approximately to 50 years. Higher life expectancy is an indication of new developments, innovations and the availability of basic resources and infrastructure that benefit people's wellbeing like hospitals and medical centers which were made available to the public, better living conditions, nutrition, water availability and a better economy.

According to Bor *et al.*, (2013), South Africa's life expectancy started to increase in 2011 reaching 60, 5 years which was 11,3-year gain in the mean length of life relative to 2003. This means that there has been a fluctuation in the numbers of years into which people could survive in South Africa due to numerous factors such as unemployment, lack of education which may cause the lack of knowledge among the South African population. Hypothetically, life expectancy is increasing but the consequence of socioeconomic variables on life expectancy has not been established clearly in the South African context also, poverty and inequality remain an increasing issue. This research seeks to explore the consequences of socioeconomic variables in life expectancy in South Africa.

Williamson and Boehmer (1997) have found that being uneducated may also have a negative effect on one's health more especially if the person is a female. Sede and Ohemeng (2015) found that secondary school enrolment as measured by the matric attainment affect life expectancy in a country. This means that hypothetically, uneducated people have shorter life expectancies as compared to the educated people. Williamson and Boehmer (1997) confirmed in their study that education had a positive impact on female life expectancy.

Gwangwa (2017) argued that Pali Lehohla (former statistician general) stated that being educated has a potential for eradicating poverty, indicating an irrefutable association between poverty and education. Studies conducted indicated that 79, 2% of individuals without any formal education were poor compared to 8, 4% of individuals possessing a post matric qualification in the year 2015. Uneducated people live mostly below poverty because they do not get high paying jobs and have a low level of productivity thus showcasing that without education people will remain poor and as the country continues to be dominated by uneducated people the bane of poverty is far from over (Gwagwa, 2017).

Figure 1,2: SA life expectancy



Source: data source from The World Bank

South Africa's former statistician-general Pali Lehohla states that South African life expectancy dropped by 4,3 years between 1990 and 2013 according to Health24 (2015). Health24 (2015) further asserted that by contrast in 1990 women lived on average of 68,9 years and men had a life expectancy of 60,5 years. This study envisions to explain the motives linked to the fluctuation in South African life expectancy. The fluctuation in life expectancy is influenced by several factors such as that of health policy implementations and the socioeconomic variables. Some of these socioeconomic variables mentioned above have a causal relationship with life expectancy and variations do occur between male and female life expectancy. South Africa's life expectancy will hypothetically continue fluctuating for as long as health policies are not implemented in a manner that will be suitable for life expectancy increment.

Stafford and Marmot (2003) have indicated that the persons place of resident can be used to explain an individual's deprivation of social resources. Griffiths and Fitzpatrick (2001) recognized that there was a strong connection between deficiency of social resources at local authority level in England and life expectancy, these authors discovered that a declining life expectancy was related to growing deficiency and that this association was stronger for males than for females.

Life expectancy at birth for 2014 in South Africa was estimated at 59, 1 year for males and 63, 1 year for females. In 2013 males were estimated at 57, 7 years with females at 63 years. This indicates the difference in estimated life expectancy for both genders. Though most social resources have been made accessible to people it is argued that males are more likely to die younger than females. According to the Writer (2016) by 2050 the average life expectancy in South Africa is predicted to rise to 63, 2 years of age at birth whereas in 2040 it has been predicted that life expectancy will on average be 69, 3 years (Mail Online, 2018). This indicates that the predicted life expectancy will decrease from 2040 to 2050.The decrease in life expectancy can only occur if the health scenario does not become better (Sokutu, 2018). If basic health resources are only accessible to a few populations, life expectancy might decline.

In South Africa, as in other developing countries, disparities in indisposition and death have been linked with a diversity of variables that can be used to measure the socioeconomic status. Sede and Ohemeng (2015) indicated that there is an important propensity for death rate to be lower in countries with evenly distributed income though Nigeria is not democratic in how income is distributed. Higher level of health care has a significant relationship with per capita income.

The accumulated number of AIDS deaths in 2004 was estimated by the Statistics South Africa (2009) at nearly 1, 5 million. The growing number of AIDS orphans was estimated by the UN in 2001 at nearly 700 000 and in 2002 it was estimated at 150 000.Asindicated by Marmot (2010), reducing of health inequality would benefit several communities in numerous ways as fatalities associated with health inequality would be reduced as access to health facilities would be equally distributed. Health inequality accounts for most production fatalities, higher health expenditures and treatment costs in health facilities. Fixing these disparities would therefore have a significant effect in improving life expectancy as health plays a major role in an individual's wellbeing (Marmot, 2010). Total health expenditure is defined as the ratio of total expenditure on public and private health. Government expenditure on health has good implications in improving life expectancy when done properly.

Life expectancy has significant insinuations for the individuals and collective human behavior, a crucial effect on fertility behavior, economic growth, human capital investment, intergeneration transfers and incentives for pension benefits. Sede and Ohemeng (2015) state that life expectancy is an important indicator for developing countries who still have goals of improving socioeconomically as an increase in life expectancy in a country is a transparent reflection of a country's development. Population growth is also described as a continuous worldwide concept; though, the population of developing countries is growing in a faster pace than the global average (WHO, 2011).

1.2 Stylized facts: trending of life expectancy in South Africa

According to Stats SA (2014a) as South African population breaks up to 54 million, life expectancy is expected to rise. In 2005 South African life expectancy was predicted at 52 years and has now increased to 61 years. Stats SA (2014a) argued that there are two significant trends that have led to a positive increase in South African life expectancy. An increased rollout of ARV's can be distinguished as one of the prominent factors to an increase in the expected years of life. This increase resulted to decreased number of deaths from 363910 in 2014 which accounted for 51%of deaths and decreased the number to 171733 deaths in 2015 decreasing the number to 31% of AIDS related deaths. An improvement in the general health standards of the population also played a pivotal role in a decline in infant mortality. In 2002 the estimated IMR was 58infant's deaths per 1000 live births, the estimated number of infant deaths declined to 34 infant's deaths per 1000 live births in 2014.

According to Statistics South Africa (2016) between 2002 and 2005 there was a decline in life expectancy which was due to the unavailability of health programs that would prevent the mother to child transmission but the expansion of these health programs together with the access to antiretroviral treatment partly led to an increase in life expectancy after 2005.Life expectancy was therefore estimated at 60,6 years in 2015 for males and 64,3 years for females. It was stated that in 2015 there would be a steady trend in life expectancy caused by the marginal gains in survival rates which were among infants under 5years that went through post HIV interventions in 2005. Statistics South Africa (2016) argued further by stating that the number of AIDS related deaths increased in 2010 and 2011 and declined thereafter with a bit of an increase in 2015. The availability of antiretroviral treatment changed the patterns of mortality in a significant manner, extending the years of survival for many South African's.

HIV/AIDS was labeled the number one killer as 202 100 South Africans died because they were infected by the virus with 33, 2% of deaths occurring each year (Pariona, 2017). People living in rural areas and other underdeveloped areas are more likely to carry this virus and other implicated diseases undetected for longer periods making this more complicated. From 2013, South Africa had a population size of about 53 million. Of this size, 30% aged less than 15 years with only 9% of the population is over 60 years of age. Above all 64% of these inhabitants live in urban areas resulting in high birth registration in such areas than in rural areas. Stroke, diabetes and lack of access to health care facilities are also the leading causes of death in South Africa. The afore mentioned leading causes of death in South Africa indicate the importance and how vulnerable the country is with minimum government expenditure on health services and what the negligence for health service delivery to certain areas like rural areas can live life expectancy at.

In South Africa, people living in rural areas have access to a few health care services (Pariona, 2017) and some must travel long distances to reach health care services. To areas where health care centers are available, the primary health care has a poor service, which is underfunded and use old materials due to financial restrictions in the public sector. Government's education expenditure is increasing at a steady trend; this indicates a vacant place for improve mention education expenditure. Being illiterate may hypothetically be the one of the reasons South African life expectancy faces a decline in some extent. Pariona (2017), therefore, states that the available doctors in these areas do not match with number of patients arriving at hospitals as a result some patients are attended by nurses or midwives who do not possess the qualities of practicing the duties done by doctors. The availability of private hospitals is of good importance in some regions though they are only accessible to only a few people as they are at high costs, and most people are unable to reach them as they are mostly centered in urban areas. People living in rural areas face the greatest barriers to receiving healthcare and even when a medical post is staffed, it could still be hours away from the population.

According to Bidzha, Greyling and Mahabir, (2017) the annual growth rate in public health expenditure was 12,8% between 2002 and 2014. Public health expenditure had a negative relationship with life expectancy in 2002 to 2005 and from the year 2005 onwards a positive relationship emerged though there were predicted signs of another negative relationship in

2013. In 2002 to 2014, life expectancy at birth increased by 1% annual average rate and public health expenditure increased by 12,8% annual average rate. Government health expenditure has a significant role in an increase or decrease in life expectancy, when the government spends at appropriate areas in health development, life expectancy increases too as stated by (Bidzha, Greyling & Mahabir, 2017).

The National health department (2017) states that innovative ideas that will improve health care treatments and improve an application of practice will have to be confirmed to be effective, this is one of the main objectives for improving South African's health status. Innovative resources that will also enable the ability of preventing, treating and diagnosing conditions which occur frequently is also in the pipeline for improving the health status of South Africa. The research that was conducted provided the basics on the importance of developing evidence-based clinical practices which will also require a long-term effort for evaluating the present and new health care practices.

In 2012, the South African GDP accounted for 8,8% expenditure on health which was slightly below the OECD average of 9,3% (OECD.org, 2014). In South Africa the total education expenditure amplified over a five-year period by R80 billion. Statistics South Africa (2018a) states that in 2009/10 the total expenditure on education was R169 billion and increased to R249 billion in 2013/12 which on average the annual education expenditure rate was 10, 2%. In 2013/14 the provincial government contributed 73% which to be exact was R181 billion of the general government education expenditure. From the R181 billion, the provincial government contributed R52 billion which accounts for 21% to high education institutions. Hypothetically, implementing new strategies for delivering the message from teachers to students would work significantly with the government expenditure on education, at the later stage an increase in life expectancy would be evident.

1.3Research problem

South African life expectancy is not stable; there was a decline in life expectancy from 1994 to 2005 and an increase from 2006 to 2016. Recent studies on South African life expectancy have indicated that HIV is a dominant factor for a decline in life expectancy. There has been minimum or no research on what role socioeconomic variables have in an increase or decrease in South African life expectancy. This study uses government expenditure on education, GDP per capita, urban population, total fertility rate, the prevalence of undernourishment, government health expenditure and people with access to sustainable drinking water as variables to extrapolate a different perspective on what might be causing this fluctuation in South African life expectancy. The mentioned socioeconomic variables and health policy effects are used to further explore the impact they have on life expectancy, as they either impact South African life expectancy positively or negatively. Each mentioned variable has a causal relationship with life expectancy and this relationship usually occurs unidirectional or bidirectional. The relationship each variable has with life expectancy differs with gender. The fluctuation in life expectancy is due to many factors.

According to Biciunate (2014) a growth in economy has a significant role in life expectancy if the growth is used for financing social services such as providing access to sustainable drinking water, healthy sanitation, availability of health care centers and an improvement in basic education. This research seeks to understand what negative implications low life expectancy have in the production of the economy. Statistic South Africa, (2018d) indicates that South African GDP per capita for the second quarter in 2018 had declined by 0,7% leading to the second recession in South African economy as in the first quarter there was a 2,6% GDP contraction.

Lack of understanding onto what effect government expenditure on education, government expenditure on health and GDP per capita might have to a South African population will put its life expectancy at stake. This is because the three mentioned variables are a link to undernourishment, fertility and good access to water to every individual living in urban and rural areas. This study seeks to understand what impacts the variables under study have on the meandering life expectancy. It has been indicated that these variables either are significant, granger cause each other or correlate.

Parental loss at an early age has an impact on how children left behind are left to grow and the kind of lifestyle they adopt. A lower life expectancy lead to broken households, children are meant to survive on what is available to them. In specific terms some children end up committing crime, taking drugs and living a careless lifestyle which affects the expected years of survival. Death occurring during the working age becomes a threat to the economy. As people of working age die before they reach retirement age this therefore mean companies will have to invest mostly on training new employees thus affecting the economy with such expenses. This research will enable us with an understanding of how socioeconomic variables and health policy impact life expectancy and an understanding of the causal direction between the socioeconomic variables and life expectancy. An indication of how male life expectancy differ from female life expectancy will be evident.

1.3.1 Research hypothesis

1. Socioeconomic variables (government expenditure on education, GDP per capita, urban population, total fertility rate, the prevalence of undernourishment, government health expenditure and people with access to sustainable drinking water) and health policy efforts do not have any significant impact on life expectancy.

2. There is no causal relationship between socioeconomic variables (government expenditure on education, GDP per capita, urban population, total fertility rate, the prevalence of undernourishment, government health expenditure and people with access to sustainable drinking water) and life expectancy.

3. Life expectancy for females tends to be higher than that of males.

1.3.2 Research question

1. To what extent have health policy efforts and other socioeconomic variables (government expenditure on education, GDP per capita, urban population, total fertility rate, the prevalence of undernourishment, government health expenditure and people with access to sustainable drinking water) influenced life expectancy of South Africa?

2. What is the causal direction between life expectancy and some of these socioeconomic variables (government expenditure on education, GDP per capita, urban population, total fertility rate, the prevalence of undernourishment, government health expenditure and people with access to sustainable drinking water)?

3. What are the variations between life expectancy of males and females?

1.3.3 Research objective

1. To determine the impact of socioeconomic variables (government expenditure on education, GDP per capita, urban population, total fertility rate, the prevalence of undernourishment, government health expenditure and people with access to sustainable drinking water) and health policy efforts on life expectancy

2. To investigate the causality relationship between life expectancy and socioeconomic variables (government expenditure on education, GDP per capita, urban population, total fertility rate, the prevalence of undernourishment, government health expenditure and people with access to sustainable drinking water).

3. To examine the differentials between males and females on life expectancy.

1.4 Significance of the research

Life expectancy is the roadmap to existence, if life expectancy is not studied the roadmap would be unknown. In a nutshell a research on life expectancy will serve as a guide to other researchers through an analysis of activities, patterns and all interactions that takes place within the systems and subsystems of the human body. The complexity of life itself is the primary reason as to why life expectancy must be studied from birth to death as understanding what may bring to a more well lived life and what may decrease the number of years an individual is expected to live would provide the source of how an individual would try living life with dignity, self-care and purpose.

It is important to study life expectancy because humans are now living longer. In addition, the study of life expectancy looks at different factors; social, economic, mental, and physical factors that can affect people at each phase of their lives. This is important as it helps researchers to understand how people can continue to live a meaningful life of up to older ages. Understanding the relationship between life expectancy and the socoeconomic variabless in South Africa is important. The effect each variable has on life expectancy can be distinguished as common knowledge , these socioeconomic variables therefore helps at understanding their relationship with life expectancy statistically.

Specifically:

1. The study will provide general information on the issues affecting life expectancy in South Africa and enable policy makers to seek measures to help enhance the life style and life expectancy of South Africans.

2. This study will be beneficial to every individual in the country as it enhances the knowledge of the factors contributing to life expectancy.

3. The study will provide the necessary information which will enable government to further explore the spheres of service delivery that require more attention and funding.

1.5Conceptual definitions

Life expectancy, education, GDP, urbanization, total fertility rate, undernourishment, health expenditure and access to sustainable water are variables that form the foundation of this research. This research seeks to understand the socioeconomic determinants of life expectancy in the post-apartheid South Africa. Before understanding further which variable has a major impact in a decline or increase in life expectancy, understating the basis of each variable in the study is important. The decline or increase in people's life span is due to several factors, both natural and man-made. In explaining life expectancy, the mentioned variables are used with each variable defined in a manner that may differ to other studies. The GDP in this research is examined as the foundation for financial inequality. Hypothetically, financial inequality restricts several people to access basic resource; for instance, some people living at the outskirts have no access to sustainable water, health facilities and are illiterate. The mentioned factors are key to government expenditures. If the government caters for certain people neglecting those at the outskirts causing inequality in distribution, this can be the fundamental of a slight increase/ decrease in South African life expectancy.

Life expectancy

Life expectancy is characterized as a factual measure of the normal time an individual is required to live, in view of the time of birth, current age and other statistic factors including sex (Kinsella & Ferreira, 2007). Life expectancy is studied by determining the impact of socioeconomic variables and health policy efforts on life expectancy and through investigations of the causality relationship between life expectancy and the socioeconomic variables. Life expectancy is again studied by examining the differentials between males and females.

GDP Per Capita

GDP is defined as the overall amount of all goods and services produced in a country in a year. It is a very significant indicator of economic growth in a country and a positive change is an indicator of economic growth (Statista, 2018). A country with a good economic strength can sustain its population whereas a weak economy would lead to a decrease in life expectancy due to a lack of resources for sustaining the population. This variable is significant to be studied as a determinant of life expectancy due to the role it plays by either increasing or decreasing life expectancy.

Expenditure on education as percentage of total government expenditure

Government expenditure on education is expressed as a percentage of GDP. Expenditure on education includes expenses that are funded by transfers of resources from international sources to government (Indexmundi.com, 2018). A high expenditure on education is equivalent to an increase in life expectancy. Hypothetically, if the government would spend more on education, spending in both private and public school this would reduce the number of illiterate people thus increasing life expectancy as individuals would have ability to read the basic information required for survival. An elevated total government expenditure on education in a country would show the level of development a country is in terms of investing on education.

Health expenditure per capita

Generally, health expenditure by government refers to expenditures received by central, regional and local government authorities (Stats.oecd.org, 2018). The whole process of life from birth to death passes through the concept ‘health’. For survival, spending and investing more on health would improve life expectancy through means of enhancing the quality of health facilities, number of physicians, number of hospital beds, creating medical innovations and making a point that every individual has access to health facilities. Living in environments where government invest on health is living in an environment where the expected years of survival can be reached. The formulation of health policies cannot be sustained if the government is not prepared on spending on health.

Urban population

Urban population refers to the populace that live in urban areas. Urban population so as rural population is measured in terms of available resources that can sustain the number of individuals. A minimized number of people in both areas lead to an effortless flow of service delivery.

Total fertility rate

Total fertility rate (TFR) is defined as the number of offspring’s a woman of theoretical group would give birth during her life time if she were to give birth to offspring for her entire life at the rates defined by the age specific fertility rate for a certain year if none of the children die before reaching the reproductive age.

TFR is calculated as the total of the ASFRs of women by single years of age from 15 to 44, calculated per women and then divided by 1000.When the ASFR's is given for 5 year-age intervals, the total must be multiplied by 5 and divided by 1000.

Percentage of people with access to sustainable drinking water

Percentage of people with access to sustainable drinking water is measured by a percentage of a population with access to safe drinking water located within an opportune distance from the user's residence. Drinking antiseptic water have a good intention with life expectancy as drinking contaminated water leads to severe health infection diseases that may lead to death. The prevalence of unavailability of sustained water is frequent mostly in informal settlements, rural areas and other areas in the outskirts. In areas mostly where sustained water is not available, people don't live up to their old ages thus experiencing a decline in life expectancy. This variable is important in this study because it attest on to what effect this variable has on South African life expectancy.

<u>Prevalence of undernourishment</u>

Prevalence of undernourishment explains a population's nutritional energy consumption by showcasing a percentage of population whose food ingestion is deficient to meet nutritional energy requirements incessantly (Indexmundi.com, 2018). This study therefore investigates what impact or causal relationship will this variable have on life expectancy.

CHAPTER TWO: Review of Related Literature

PREAMBLE

Life expectancy is described as the average number of years a person could expect to live. Each country calculates the life expectancy rate using a different methodology. The different methods used in dissimilar countries can affect the way we compare life expectancy. This study determines the impact of socioeconomic variables and health policy efforts on life expectancy. Socioeconomic variables and the health policy efforts play a major role in increasing and decreasing life expectancy. The health policy efforts also play a vital role in improving life expectancy as they state or provide methods into which the quality of care in health sectors can improve. Grossman (1972) states that people are the producers of health. This can then be argued by stating that the lifestyle that a person desire determines the number of years that person will live. In developing countries variables such as illiteracy, urbanization, access to drinking water and the percentage of doctors per population play an important role in determining life expectancy. According to Bidzha, Greyling and Mahabir, (2017) life expectancy and infant mortality rate are the health outcomes. According to Anyanwu and Erhijakpor (2007), the death of children under five years is also distinguished as an indicator of how accessible and how effective the availability of health care centers can be.

The meandering life expectancy is caused by a variety of socioeconomic variables that are not sustained properly. For instance, if a government does not provide a population with sustainable resources that might improve their lifestyle, ailments and death might be the peripheral outcome. Several studies argued that as per capita income increases the population's health status improves. Furthermore, the higher the availability of income in countries and the more improvement on public health infrastructures such as water, sanitation, better nutrition, better housing and the ability to pay for healthcare centers, the more the life an individual is expected to live. This explains the reason as to why life expectancy decreases in some countries, when the country's economy (GDP per capita) is poor it cannot sustain the available citizens in that specific area leading to more death's as people have no access to the sustainable basic needs. This, therefore, leads to a decline in life expectancy.

Both males and females differ in the number of years they can live. Faulds *et al*., (2012) argued that the physical difference between males and females acted as source of why their life expectancy differs. The physical advantage and how strong, taller and less overweight men are, is one of the advantages that men possess even though none of these qualities guarantee long life because this is not usually the case for both genders (Drevenstedt *et al*., 2008).

South African life expectancy is growing at a stable rate. Hypothetically, South African life expectancy would have met the millennial development plan which aimed at reaching to at least 70 years by 2015 if the country would have resolved its complex problems. The South African NDP 2030 objective is to recover South African economy. The NDP 2030 came forth due to the slow progress in developing South Africa after 1994 (The Presidency, 2011). South Africa came with a plan which was based on jotting down the country's weakness and strengths, the identified reason for such failure were then released as a diagnostic report in 2011. The diagnostic report highlighted reasons as to why there is such failure since 1994 and set out the nine basic disputes which affected the country. They highlighted that in South Africa it was only a few people who were employed with the quality of education made available to disadvantaged schools and the infrastructure was poorly maintained. The high level of corruption in South Africa was also highlighted as the push factor in developing South Africa. Corrupt countries are more divided and experience difficulties in developing resulting to public health struggling to meet demand and sustain quality.

The mentioned challenges were accepted and regarded as a constructive assessment by South Africans from all walks of life (Alexander, 2017). The National Development Plan escalated from the medium-term strategic framework (MTSF) 2014 to 2019 that pointed out 14 main concerns that needed attention to the NDP vision 2030 which only indicated six major priorities. The MTSF 2014 to 2019 prioritized, basically the quality of education, an improvement in life expectancy through a healthy life for all which can also be secured through decent employment. The above-mentioned national development plans play a vital role on policy implications.

2.1 Theoretical Literature

2.1.1 Objective 1- to determine the impact of socioeconomic variables and health policy efforts on Life expectancy

According to Bidzha, Greyling and Mahabir (2017) investing in health is significant in South Africa which can be done through public health expenditure. According to Bidzha (2015) there is a dual system in South Africa that consist of public and private health care services with negligible financial services from donors and NGO's. There are health care services offered by government and easily accessible to people constrained financially, the public hospitals and clinics render services such as primary health care which are done through means of in and out patient care to pre-emptive care and health elevation of services. The number of physicians per 1000 populace is strongly correlated with life expectancy (Keita, 2013). Shaw JW. *et al*., (2005) argue that improvements in health care services through increasing the number of doctors, hospital midwives and prenatal examination reduce the death rate therefore increasing life expectancy. Mahfuz (2008) supports Shaw JW *et al*., (2005) argument based on life expectancy increasing when there's availability of health resources. Mahfuz (2008) argued that life expectancy can be determined by the primary health care programs with a positive relationship between primary health care expenses and status of an individual's health. People are considered as producers of health as they have the choice to eat the desired food and have access to health care centers. People are constrained in health as they have financial resources and natural resources. Bidzha, Greyling and Mahabir (2017) stated that Coovadia *et al.*, (2009) in their research stated that the historical background of South Africa influences the population's health status and the health policies of today. An improvement in accessibility to health care services and the outcomes that come with these improvements are considered as determiners of economic growth and are part of the developmental goals as from the beginning of the democratic indulgence in 1994 (Burger *et al.*, 2012).Sauvaget *et al.*, (2011) stated that a better quality of life worldwide is due to prevention of diseases, the availability of effective treatments, intake of nutritious food, the level of education, living and working conditions. Lin *et al.*, (2012) argued that improvements in life expectancy can be accredited more directly to enhancements in the national economy than to the other factors. Regarding variables directly related to the health system, Lin *et al.*, (2012) further emphasized that they found that expenditure on education had a positive significant effect on life expectancy.

Higher education develops people's capacity to increase their sense of personal control, mastery, and self-direction. People with high levels of personal control are more knowledgeable about health and they are more likely to avoid unhealthy lifestyle. Cremieux *et al.*, (1999) shares a similar opinion on socioeconomic variables having an impact on life expectancy by arguing that income per capita, public health spending, safe drinking water, calorie intake and literacy are the main determinants of life expectancy.

Biciunaite (2014) uses Preston's curve in explaining the relationship between life expectancy and income by indicating that people living in wealthier countries can expect to live longer on average compared to people living in poor countries. This is not really the case for some countries, a significant relationship between life expectancy and GDP per capita becomes efficient when the economic growth in a country decreases malnutrition. Income and statistic factors are known to impact the expected life of people, networks, locales or nations (Sauvaget *et al.*, 2011). Although proof on social disparities in wellbeing comes for the most part from high-asset nations, reports from countries like India much of the time analyses rank related with wellbeing result, being a marker of financial status. Sauvaget *et al*., (2011) contend that the fundamental driver of death, which was recorded for 88 percent of death cases, were incessant and non-transmittable infections. Cardiovascular ailments spoke to the principal reason for death (42%) preceding malignancy (13%) and constant respiratory sicknesses (12%). Lin *et al*., (2012) further argue that labor productivity effect and a positive effect on economic growth are a result of an improvement in life expectancy.

Ali and Ahmad (2014) states that developed countries invest more on health, education, sanitation, environmental management and other social security. Ali and Ahmad (2014) further argue that an increase in per capita income and changing the expenditure structure in developing countries could have a positive impact on life expectancy. Macroeconomic factors have a very strong impact on life expectancy as rising inflation decreases the purchasing power of households.

The South African National Development Plan (NDP) for 2030 aims at improving South African inclusive economy thereby unleashing the energy of its citizens by working together with its leaders solves complex problems (The Presidency, 2011). This imminent NDP 2030 came forth due to the inadequacy caused by the slow progress of development in South Africa after 1994. It is stated from the UNICEF (2017) that the composition of spending in South African provinces is dependent on transfers from the national government. The national government's transfer framework benefits mostly provinces as evidence by the large investment in HIV/Aids conditional grant. South African government is challenged with a lot of areas for improving health; the government is encouraged to improve the targeting of health services.

UNICEF (2016) states that the total government education expenditure budget remains at 17%evenafter concerns on education expenditure lacking growth over the medium term. The government is therefore encouraged to spend more on priority programs that would uplift the education growth rate, these programs include early childhood education, the national school nourishment program whereby a student will be provided with at least one nutritious meal a day during school hours, the no-fee school allocation which would boost or benefit mostly students from households where there is not enough money to invest in a child's education, support for public special school education and infrastructure spending in the most disadvantaged areas. If the government would place priority on the mentioned encouragements, a greater increase in life expectancy in the upcoming years would be evident. Labadarios *et al*.,

(2011) argue that regardless of advancements that have occurred in South Africa since 1994, the country is still overwhelmed by unemployment and poverty. This follows the global crisis that is affecting the economy; this economic crisis therefore means that there will be an increase in food and fuel prices, there will be high energy tariffs and an increase in interest rates.

The National Department of Health (2017) prioritizes finding means into which they can reduce the burden of disease, mortality and try improving the patient's quality of life. The National Department of Health's (2017) objective through addressing health policy, aims to improve the quality of health care services through provision of health care capacities, this objective will therefore have an influence in increasing the health care use as an extension of health care services delivered will thereby be accessible to the previously underserved population. The policy also takes into consideration people living in rural areas as it plans on developing new methods for delivering quality health care; this includes provision of high-quality doctors. Involving community members in decision making when it comes to health care services is another factor mentioned also aiming at improving health services which will later play a pivotal role in improving South African life expectancy. An education is also an important factor when it comes to health care services as previous studies found that in most situations being illiterate had a significant role in a process of taking medication as some people could not understand what and how to take the medication provided to them. Being literate would benefit South African life expectancy as people would be able to read on what needs to be done when faced with certain situations.

2.1.2 Objective 2- investigate the causality relationship between life expectancy and socio-economic variables

Bicuinaite (2014) indicates that there has been a sequential significant relationship between food prices and mortality. However, people from low income household tend not to afford the basic nutritious food and at risk for mortality compared to people living in wealthy households. The technical recession in economic growth in South Africa might have a positive and negative causality relationship towards South African life expectancy higher economic growth can imply more job opportunities, better access to health care services and access to housing. Higher wages do not always pilot to higher life expectancy (Bicuinaite, 2014). There are several developed countries that are wealthy but not industrialized and there are not so wealthy countries which are industrialized. Inequality in income distribution might be one of the leading factors as to why a developed country can still not be industrialized or might have less expected years for survival.

Keita (2013) states that Rogers (1979) noticed that life expectancy rises at a weakening rate as there is an increase in income. Life expectancy also has an influential determiner that is education. Studies have affirmed empirically about the role education has when justifying the variance in health status. Keita (2013) also highlights that the expected years for survival differ in relation to education. Grossman (1972) stated that price increases have a negative relationship with life expectancy; thus, inflation disturbs a household's wellbeing. Gupta *et al.*, (1999) had stated that the population's health status improves as per capita incomes rise, thus proposing that expanding wage would be related with bringing down under-five years and new-born child death rates (Anyanwu & Erhijakpor, 2009). Also, higher earnings are prompting enhanced general wellbeing frameworks, for example, water and sanitation, better nourishment, better lodging and the capacity to pay for human services (Pritchett &Lawrence1996) and (Cutler *et al.*, 2006). Asafu-Adjaye (2007) and Smith (1999) contend that medical problems became critical because they are presently seen as critical contributions for economic development, decreasing destitution, and accomplishing long haul monetary improvements. Bokhari, Gai and Gottret (2007) discovered that expanded government spending added to positive results in under five years mortality and maternal mortality.

Mba (2007) contends that education is the ground-breaking determinant of life expectancy. According to Mba (2007) the relationship between economic status and mortality has increased as levels of training, income, riches or occupational are related. For a few reasons, demographers have primarily centered on educational accomplishment. People with practically zero formal education regularly wind up in low-salary employments and may need to perform strenuous work and that likewise add to the length of their future: Scarce economic assets are frequently connected with living in unfortunate lodging conditions, eating low-quality nourishment, contingent upon the institutional setting and being not-able to bear the cost of medicinal services. Hoi *et al.*, (2009) contend that disparities in income and education were as of late found to represent local imbalances in life expectancy and other wellbeing markers.

UNICEF (2017) argues that South Africa's health expenditure rate compared to other African countries is favorable. South Africa is indicated as one of the highest investors in health, spending more than some of the neighboring countries but less than Lesotho and Malawi though from the granger causality results it was not evident that the health expenditure have an impact on life expectancy. In improving life expectancy, the NDP 2030 had to come with strategies that will improve life expectancy through guidelines that will develop the country. The NDP 2030 plans on improving schooling sectors through the collaboration of their strategic plans and the DBE's action plan to 2019. Some of the key goals on planning is the provision of equal access to one phase of early child development which is named the reception year prior to grade 1. By 2030 South Africa's ranking in international comparative standardized test must improve through provision of performance benchmarks, eradication of infrastructure backlogs and making it a point that all schools are funded at the minimum per-learner levels.

The school nutrition program has achieved inspiring coverage and is helping large numbers of people from not wealthy families (UNICEF, 2017). It is also under plan to gradually increase the nutrition programs to other poor secondary schools. This extension can act as a substitute in eradication undernourishment/malnutrition to young children as students will have access to basic food at least once a day during school operating hours.

Williamson and Boehmer (1997) mentioned on Ali and Ahmad (2014) study states that education have an impact on health in two ways as education enhances the productivity of labor which increases income and improves the livelihood of people. Education keeps people awoke as they become aware of health indicators that need proper consideration. The socio-economic inputs such as public health expenditure, income (GDP) and level of education do not directly impact health outcomes but indirectly through proximate determinants (Bidzha, Greyling & Mahabir, 2017). Bidzha, Greyling and Mahabir, (2017) further explains the above by stating that public expenditure on health provide resources for the purchase of vaccines while the literacy level of the mother may assist with correct usage of the prescribed medication leading to better health outcomes.

SAHRC (2014) indicated that "the lack of hygiene has a huge impact on school attendance, especially for girls," and "diarrhea is also a major problem that leads to deaths and high absenteeism". Diarrhea is an effect of drinking and the use of not purified water.

2.1.3 Objective 3- examine the differentials between males and females on life expectancy

According to Keita (2013) life expectancy for females is recognized to be higher at birth than that of males in almost all the countries. Keita (2013) further base the argument by stating that the United Nations, Department of Economic and Social Affairs, Population Division (2011) argue that the expected life for females was 70 years and for males was 66 years in 2010. In developed countries the female's advantages place their life expectancy at around 7 years more whereas in developing countries female life expectancy is around 3, 5 years less. In the third world, life expectancy has profoundly expanded, particularly in the past thirties (Anyanwu &

Erhijakpor, 2009). This has been joined by an expansion in the gap amongst male and female sexual orientation regarding survival. The difference is awesome to a degree that the components behind it must be set up. The disparities that have been watched for the most parts from the age of 20-35 years and have been related with heart disease rates, which supposedly are higher in males than in females (Longevity Science Advisory Panel, 2012). The gap has additionally expanded in most created nations since the Second World War. Another perception is that the sex difference at late adulthood and the start of seniority have been moving incredibly (Murphy & Topel, 2006). It was high in the 1960s in the ages 55-to 65 years. In this way, the mortality in seniority has been high throughout the previous three decades.

It is evident that life expectancy in developed countries is higher for females and lower for males (Murphy & Topel, 2006) but this different for different countries. Longevity Science Advisory Panel (2012) indicates that it is evident that after the age of 30 a difference exists in mortality. Heart related deaths have been associated with diseases that also affect mostly people of adult age. Ehiemua (2014) argued that the disparities between males and female's life expectancy has been evident since the 20th century more especially the high female frequency of life expectancy compared to male's life expectancy, the first determiner for this difference is the physical variance between males and females (Faulds *et al.*, 2012).

Men are gifted with smaller health reserves, mostly at birth. Secondly, the difference could be because of the different roles men and women play in their society. Studies conducted on the differences that occurred in the 20th century show that the biological difference between men and women as well as the difference in their roles collectively differ. Murphy and Topel (2006) argue that there has been a minimum research conducted on how socio-cultural factors and life expectancy. It has been discovered that males have an inclination of fetal mortality. These differences between the two genders have been associated with the ischemic heart disease deaths. Waldron (1995) analysis the different types of biological factors affecting both genders and concluded that the females sex hormones can reduce diseases that may impact females through the serum lipids they have. For males this is different as they have a high testosterone that cause uncomfortable effects on serum lipids; with their abdominal body fat indicated as another factor that leads to heart related diseases thus minimizing their expected years of life (Faulds *et al.*, 2012).

Murphy and Topel (2006) states that only a small section can be explained using biological factors; the disparities that occur in life expectancy can be explained by focusing on

Environmental, social and behavioral factors as they play a major role in these disparities. Smoking, the kind of diet people choose, and access to poor medical care can be distinguished as behavioral factors with a major role in life expectancy disparities. The mentioned factors contribute to the disparities in adult aging (Longevity Science Advisory Panel, 2012). The above-mentioned behavioral factors become evident in heart related diseases and lung cancer that becomes a health issue due to bad habits specifically smoking (Faulds *et al*., 2012). Smoking can be referred to as a strong ground for making an argument on gender disparities as men smoke more than women (Longevity Science Advisory Panel, 2012). Heart related deaths in studies that were conducted in the 1950's proved smoking as one of the leading factors to the differences in life expectancy for males and females (Murphy & Topel, 2006). This disparity in gender related deaths can be associated with smoking and the alcohol intake behavior between men and women.

Men's physical advantage is being taller, stronger and less weighty. However, none of these qualities assures them long life (Drevenstedtet *et al*., 2008) thus; the women live longer than men. Drevenstedtet *et al*., (2008) argues that in a comparison that was conducted in the USA on the mortality it was evident that men and women have different patterns of mortality. Males are indicated to be three times likely to die younger when compared to females (Faulds *et al*., 2012). These deaths are caused mostly by an irresponsible behavior or violence; the deaths are mostly associated with motor accidents, murder, suicide, cancer and drowning, especially for men at the age of 15 to 24 years (Faulds *et al*., 2012). Action on Smoking and Health, (2013) argues that men and women's life expectancy differ because of alcohol and smoking; alcohol and smoking killing more men than women with the disparities in gender linked with heart related diseases. At 40 years of age there is high risk for men to be affected by cardiovascular related diseases whereas for women is after reaching menopause (Action on Smoking and Health, 2013).

Abolishing poverty is philosophically indicated to be the most challenge facing South Africa as of today. The high level of socio inequality and the inaccessible resources are one of the leading factors to high poverty rates as a result woman headed households and people with a few to no resources leaving at rural areas are the high-risk population when illuminating poverty. The incapability to recompence for water services is a manifestation for poverty, water is a prevalence resource though it is inaccessible to certain people; this affect mostly households that are not financially well off. Williamson and Boehman (1997) states that increasing education advances the physical condition of women inside and outside of their home and this also helps women in improving the health of their family and child survival.

2.2 Empirical Literature

2.2.1 Objective 1- to determine the impact of socioeconomic variables on Life expectancy

In a study conducted in Nigeria, Sede and Ohemeng (2015) investigated the socioeconomic determinants of life expectancy and concluded that the socioeconomic determinants accounted for 90% gains in life expectancy given a lag of up to three years. From their crucial analysis, it was evident that the traditional socioeconomic variables which were prominent in determining life expectancy for developing countries were not momentous in their context. They stated that there was no guarantee that enhancements in socioeconomic variables on health may wield constructive unrelenting effects on life expectancy of Nigeria. However, suggesting that if special attention could be given to quality government health capital expenditure to be exact, the expenditure on medical infrastructure, equipment, and other health deliverables life expectancy could improve. Rogers and Wofford (1989) discovered that the variables under study which include urbanization, average calorie per person, access to drinking water have a significant role in determining the number of years into which people will die for developing nations including agriculture and number of doctors per population.

In 2004, life expectancy increased from 52, 2 years to 61, 2 years in 2014; even though this is still regarded as lower life expectancy compared to other developed countries. In South Africa, government expenditure on health continues to play a significant role on life expectancy as it improved the quality of life through sustaining the expansion of the HIV/Aids treatment and prevention programs, revitalizing public health care facilities and ensuring the provision of specialized tertiary hospital services. Government expenditure on the above-mentioned services takes up to 85,2% of the department's total budget (Estimates of National Expenditure, 2015). Filmier and Pritchett (1999) found that government health expenditure accounts for less than one-seventh of one percent variation in under five child mortalities across the country (although the results were not statistically significant). Filmier and Pritchett (1999)further express that 95% of the variation in fewer than five child mortality can be explained by factors such as per capita income, female educational attainment, and choice of region.

Life expectancy in the post-apartheid South Africa has been changing due to certain factors such as the prevention of HIV/ AIDS: after falling dramatically from 62 years in 1994 to 53 years in 2010, and recently 62 years in 2015. The recent recovery was due to the rapid expansion of the antiretroviral treatment programs to fight HIV/ AIDS and it is also supported by declines in both adult and infant mortality. According to the Stats SA (2014a) report, life expectancy at birth was at 61 years after increasing from an estimated 52 years in 2005.Government health expenditure is appraised to rise with income per capita; hypothetically, countries with a GDP per capita spend more on health as these two variables have a bi-directional relationship. In the OECD (2001), South Africa ranks below average when explained in terms of health expenditure per capita. South Africa spent 982 USD in 2012 and this was calculated based on their purchasing power parity compared with an OECD average of 3484 USD (Oecd.org, 2014).In South Africa, as with many other developing countries, variations in indisposition and death have been associated with a wide diverse measure of socioeconomic status including per capita income, adult literacy, unemployment, government expenditure and education (Sede & Ohemeng, 2015). Research has shown that there is a propensity for death rates to be lower in countries that have more distribution of income.

According to Mondal & Shitan (2014), the health status of a nation can be derived with the help of health production function which consists of some inputs and outputs. Moreover, Mondal and Shitan (2014) further states that life expectancy or morbidity can be referred to the output of health production function, with inputs being referred to independent socioeconomic variables like health care centers, education, the environment, a lifestyle an individual chooses, genital factors, medical and health expenditures. Mondal and Shitan (2014) states that recent studies examining the possible determiners of life expectancy found that the most important determinant of life expectancy was income. According to the report made in the National Treasury Website (2015) a noteworthy development has been made over the last ten years towards certifying a long and healthy life for all South Africans.

Kalediene and Petrauskiene (2000) argued that for both developed and developing countries, urbanization was one of the important determiners of life expectancy. In urban areas access to better services has a significant impact in an increased life expectancy, these services include but not limited to better medical services and hospitals, access to schools with better infrastructure and facilities that will be beneficial to the upbringing of a student (Kalediene & Petrauskiene, 2000). Macfarlane *et al*., (2000) identified safe drinking water as an important determiner of life expectancy in developing nations.

Campbell and Edwards (2012) have argued that people share different social attitudes towards their body and how they tolerate pain. This becomes clear in terms of the amount of time different people take to seek health and medical intervention. It is prospective for people who are less educated not to be able to identify the morose nature of a given pathology; these people also have a higher level of tolerance to pain and are less likely to seek out for medical care. Similarly, people who are less educated have a habit of mistrusting medical science and technology compared to higher educated people. Rogot *et al*., (1992) further express that life expectancy varies with mean year schooling. Several other studies that were reviewed have linked changes in mortality rates in terms of resources that are used at the hospital, managed care and educational status of parents (Filmer, Hammer & Pritchett, 1997; Cutler& Miller2005).

Several studies have found that unemployment may have detrimental effects on one's health: Doyle *et al*., (2005) reported that employment is a major determinant of health. Doyle *et al*., (2005) argue that unemployment is one of the causes of the premature deaths in a South African population. It has been found that unemployed people with no previous illness are 37 % more likely to die than the general population; poor people die younger and experience more illness throughout their lives than the rest of the population. Also, having a job or an occupation is an important basis for a complete self-esteem.

In the study conducted by Sauvaget *et al*., (2011) about 20 percent of death found were for people who were illiterate while more than 12 percent of the study population received a college education. This can be justified through an understanding of how important education can be, an educated individual can easily transcribe what has been told according to their understanding, when at least in a household there is one or two educated people those people can act as educators in that household as their role will be to provide the illiterate with understanding of what has been transcribed. Most of the people studied in Sauvaget *et al*., (2011)'s study had a low household income with only 8 percent with an income of more than R5000 per month. Mortality rates and adjusted risks decreased with an increase in the level of education and an individuals or household monthly income in a significant exposure-response relationship. Ali and Ahmad's (2014) empirics conclude that education has a dual effect on life expectancy as the more educated the population is, an improvement in health conditions as well as the production of food become prominent.

The UNICEF (2017) states that the in general the expenditure trends on health agenda's as a share of total government expenditure come into view of being stable with an average approximately 13,5%. However, distributions to provincial health programs over the MTEF show no signs of constructive growth, which is concerning. The government is therefore encouraged to protect priority programs and services that benefit children; expedite its work on the National Health Insurance programs and increase its investment in programs that are successfully improving the mortality rates of young children.

Labadarios *et al*., (2011) mentions that according to Davids (2006) South Africa still distinguish themselves as a country that lacks enough income to meet their household income after 10 years of democracy. Access to food is well-defined as a household's aptitude to acquire enough food to have all its members encounter their nutritious necessities and lead productive lives. WHO (2011) further argues that in South Africa between 1999 and 2008 the incidence of food insecurity appeared to have been abridged by more than half, from 52.3% to 25.9%. However, the amount of people at risk of experiencing food insecurity continued to be virtually unaffected. The lessening was renowned in both urban and rural areas, where food insecurity reduced from 42% to 20,5% and from 62% to 33,1%, correspondingly. South Africa is expected to experience a continued increase in old age dependency as the TFR has declined over time with an increase in life expectancy (Statistics South Africa, 2018c).

National Department of Health (2017) states that each year the 8% of the GNP which is an indicator of wealth produced by a country is spent on the national health system in both the public and private health sectors. On average 60% of this is spent in the private health sector, which provides care to 20% of the population with 80% of the population relying on the public health system for health care. The public health sector receives 40% of total expenditure on health. Any national policy must therefore include both private and public sector issues, and by so doing contribute towards strengthening the partnership between the public and private sector.

2.2.2 Objective 2- investigate the causality relationship between life expectancy and socioeconomic variables

Keita (2013) argued that country prosperity is one of the most discussed health causal factors. The prosperity of a country has evidently a sturdy relationship with health and the absolute level of income which is measured per capita GDP. Public health expenditure per capita as the main descriptive variable is statistically not significant to life expectancy even it has an expected sign (Bidzha, Greyling & Mahabir, 2017). This finding can suggest that there are other factors that have an impact on life expectancy at birth that play a greater role in improving this health outcome. One of the principal goals of every government is to lengthen the life expectancy of its population by reducing its mortality rates to its minimum possible rate.

More recent research on the results of government spending on health is assorted but leans towards positive outcomes. On the bases of cross-country analysis, Hitiris and Posnet (1992) found that there is a negative association between primary health care spending and child mortality rates. On the contrary, Anand and Ravalian (1993) investigated that there is a positive significant relationship between life expectancy and per capita GNP, but it works through national income and public expenditure on health. Anand and Ravalian (1993) further state that when public expenditures on health and poverty are used as independent variables with per capita GNP the results are inverse. Grubaugh and Santerre (1994) support this idea in their investigation that there is a positive association with certain health inputs like doctors per population and hospital per population and mortality rates.

Wilkinson (1996) clarified that after attaining a threshold level per capita income, the relationship between life expectancy and standard of living to disappear and further increase in income is not attached to life expectancy gains. Wilkinson (1996) further stated that there is an unswerving relationship between health and income of the people at threshold level and there is no consistent relationship between them. However, early studies have found that there is little or no relationship between total expenditure on health and child mortality. Filmier and Pritchett (1997) have expressed empirical evidence that suggests that the government expenditure on health is not the main drive behind mortality rates, but rather the per capita income and inequality. A prior research study has uncovered a large and positive correlation between education and health (Grossman & Kaestner 1997). World Bank (1997) pointed out that there is a strong positive relationship between life expectancy and per capita income in case of developing countries. According to Bidzha, Greyling and Mahabir (2017) the GDP per capita is statistically significant at 10% level of significance and this means that a 1% increase in GDP per capita will on average, result in improvement in life expectancy by 0,2% holding other influences constant.

Some studies have found a positive relationship between spending on health and health outcomes, but others did not find any empirical evidence that shows the positive relationship between these two variables (Filmier & Pritchet, 1999; Thornton, 2002). Nevertheless, increased income has a positive impact on life expectancy. In countries like Brazil, a significant association between education and life expectancy were also observed. Moreover, longer life expectancy was associated with low infant mortality rates and high literacy rates. In the literature that has been viewed it is evident that socioeconomic variables such as education, literacy rates, government expenditure and per capita income may have a negative or positive impact on one's health. Being unemployed may have a detrimental effect on one's health and that may also lead to premature deaths.

The Census (2011) indicates that the total fertility rate continued to decline to a 2,67 fertility rates in South Africa. The pattern of a female's fertility behavior becomes evident through the information of the number of children a woman indicates. This information is important as it describes family formations and provides a clear indication of factors influencing the fertility transition in South Africa. The decline in total fertility rate from the Census (2011) data between 1996 and 2011 was indicated by a decline in PRR and an indication of the two-child preference among women aged 45-49. This led to an analysis which made it evident that the PRR by socioeconomic demographic characters indicated the partiality of progressing to higher birth orders for certain subgroups of women thus an increase in life expectancy can be expected when such changes in ferity are prevalent.

Moultrie *et al*., (2008) stated that a decline in fertility rate has stalled since 1990.South Africa has declining levels of fertility justifying why the ASFRs pattern and trends needs to be consistent. The levels of ASFR and the errors noticed in the rates acts as independent factor when estimating fertility. There was a decline in the total fertility rate in 2001 of 2,84 children per woman to 2,67 children per woman 2011. The level of decline between 1996 and 2011 is also striking, this type of pattern in fertility rate explains the countries level of development.

2.2.3 Objective 3- examine the differentials between males and females on life expectancy

Guralnik *et al*., (1993) focused on race and gender when conducting the research. These researchers pointed out that even though race plays a vital role in determining life expectancy, it is rather the educational attainments that change the results. Elola (1995) discovered that high values of both the country's gross domestic product and health care expenditures were associated with higher life expectancies for females. As it were, Williamson and Boehmer (1997) stated that a female life expectancy can be increased significantly through educational status. In developing countries, women play a more important role in family as they nurture every individual and must be well informed from the child's birth as to what health symptoms indicate a certain disease. Women act as health and sanitation practitioners in their home dwellings; education is absolutely associated with the infant's health and negatively associated with fertility rates. This, therefore, goes without saying that educated mothers are more likely to be conscious of what kind of food is served in their households. Studies have constantly established that the children born by an educated mother tend to do better with their health than children with uneducated parents. The situation changes when parents invest on their children's education as the chain flow differently due to transfer of information from children to all other individuals in the household. For example, Sastry (1997) states that in Brazil, mothers with at least three years of schooling, experience 32% lower mortality risk among their children than less educated mothers.

It is Magadi (1997) who went further and stated that its father's and not mother's education that is significantly associated with child health in Kenyan communities where the status of women is low. Be that as it may Madise *et al.*, (1999) in their study of several African countries, found that higher levels of education, secondary level of education and beyond are important to the child's health. In support of this, Sen (1999) mentioned that education enhances the productivity of labor which increases income and attainments for female and this further affects the health of child. This author found that an increase in educated people improves the health of women inside and outside of their homes, which helps them to improve the health of their family and child survival. Gulis (2000) examined that education especially for female, plays an important role in improving the overall life expectancy. Female literacy rates are an important determinant of the health status of infants and children as well as the population in general (Baldacci *et al.*, 2004).

Access to sustainable drinking water was one of the prominent factors needed by people living in poor communities since 1994. It is indicated that only about 44,7% of South African households have a tap inside their residence. 16,7% have a tap in the yard, 19,8% fetch water from a public tap, and over 14% access water from dams, river, boreholes, rainwater or water carriers or tankers. South Africa water affairs needs to prioritize the 14% that access water from dams, river, and boreholes more especially now that we are facing climate change, the water from boreholes is not evidently safe for dinking; life expectancy may be affected when such situation still occur. Developing water resources management tends to be a challenge rather than being a tool which is an end to itself.

Ali and Ahmad (2014) states that Hill and Kings (1999)and Gulis (2000) argued that female education played an important role in improving life expectancy whereas Ali and Ahmad (2014) argument is based on male's educational attainment improvement on male life expectancy. From the study it was discovered that women were not so prone to death as a result their mortality rate was lower than that of men.

2.3 Summary of Reviewed Literature

2.3.1 Objective one: to determine the impact of socioeconomic variables and health policy efforts on life expectancy

Salient Points

Sede and Ohemeng (2015) investigated the socioeconomic determinants of life expectancy and concluded that the socioeconomic determinants accounted for 90% gains in life expectancy given a lag of up to three years. According to Bidzha, Greyling and Mahabir (2017) investing in health is significant in South Africa and this can be done through public health expenditure. The number of physicians per 1000 populace is strongly correlated with life expectancy (Keita, 2013). Shaw JW. *et al*., (2005) argue that improvements in health care services through increasing the number of doctors, hospital midwives and prenatal examination reduce the death rate therefore increasing life expectancy. Mahfuz (2008) supports Shaw JW *et al*., (2005) argument based on life expectancy increasing when there's availability of health resources. Mahfuz (2008) argued that life expectancy can be determined by the primary health care programs with a positive relationship between primary health care expenses and status of an individual's health. Bidzha, Greyling and Mahabir (2017) stated that Coovadia *et al*., (2009) in their research argued that the historical background of South Africa influences the populations health status and the health policies of today.

Lin *et al*., (2012) argued that improvements in life expectancy can be accredited more directly to enhancements in the national economy than to the other factors. Lin *et al*., (2012) further emphasized that they found that expenditure on education had a positive significant effect on life expectancy. Cremieux *et al*., (1999) shares a similar opinion on socioeconomic variables having an impact on life expectancy by arguing that income per capita, public health spending, safe drinking water, calorie intake and literacy are the main determinants of life expectancy. The relationship between socioeconomic status and death has been observed in terms of levels of education, income, wealth or occupational position. Ali and Ahmad (2014) further argue that an increase in per capita income and changing the expenditure structure in developing countries could have a positive impact on life expectancy. Mondal and Shitan (2014) states that recent studies examining the possible determiners of life expectancy found that the most important determinant of life expectancy was income.

Rogers and Wofford (1989) discovered that the variables under study which include urbanization, average calorie per person, access to drinking water have a significant role in determining the number of years into which people will die for developing nations including agriculture and number of doctors per population. Mondal and Shitan (2014) further states that life expectancy or morbidity can be referred to the output of health production function, with inputs being referred to independent socioeconomic variables like health care centers, education, the environment, a lifestyle an individual chooses, genital factors, medical and health expenditures.

Kalediene and Petrauskiene (2000) argued that for both developed and developing countries, urbanization was one of the important determiners of life expectancy. In urban areas access to better services has a significant impact in an increased life expectancy, these services include but not limited to better medical services and hospitals, access to schools with better infrastructure and facilities that will be beneficial to the upbringing of a student (Kalediene & Petrauskiene, 2000). Macfarlane *et al*., (2000) identified safe drinking water as an important determiner of life expectancy in developing nations. Rogot *et al*., (1992) further express that life expectancy varies with mean year schooling. Several other studies that were reviewed have linked changes in mortality rates in terms of resources that are used at the hospital, managed care and educational status of parents (Filmer, Hammer & Pritchett, 1997; Cutler & Miller 2005).

WHO (2011) further argues that in South Africa between 1999 and 2008 the incidence of food insecurity appeared to have been abridged by more than half, from 52.3% to 25.9%. However, the amount of people at risk of experiencing food insecurity continued to be virtually unaffected. The lessening was renowned in both urban and rural areas, where food insecurity reduced from 42% to 20,5% and from 62% to 33,1%, correspondingly. South Africa is expected to experience a continued increase in old age dependency as the TFR has declined over time with an increase in life expectancy (Statistics South Africa, 2018c).

Ali and Ahmad's (2014) empirics conclude that education has a dual effect on life expectancy as the more educated the population is, an improvement in health conditions as well as the production of food become prominent. Mba (2007) argues that education is the powerful determinant of longevity. Life expectancy is influenced by the environmental, social behavior and other behavioral factors (Murphy & Topel, 2006).

Similarities

Shaw JW. *et al*., (2005) argue that an improvement in healthcare center's such as increasing the number of doctors and specialist, safe methods of giving birth and working prenatal examinations would help reduce mortality. Mahfuz (2008) supports Shaw JW *et al*., (2005) argument on the basis that an improvement in health care services would increase life expectancy and there would be a decline in mortality. The previously mentioned authors share a similar understanding of life expectancy as they both stipulate that an improvement in life expectancy can occur if an improvement in health services can occur, in the South African context and in relation to the variables that formulate the basic of this study this is significant to government's health expenditure. If the government can spend accordingly on health, life expectancy would increase.

Madise *et al*. (1999) found that higher levels of education, secondary level of education and beyond can have a positive impact to the child health more especially to a new born mother. Sen (1999) mentioned that being educated improves the productivity of labor; an improvement in labor can also be an improvement in income which will also play an important role in economic growth. Sen (1999) also found that an increasing education improves the health of women inside and outside of the home which helps them in improving the health of their family and child survival. Both these writers place their argument based on higher level of education with Sen (1999) arguing that education enhances the productivity of labor. Wilkinson (1996) clarified that after attaining a minimum level per capita income, the relationship between life expectancy and standard of living disappears and a further increase in income is not attached to life expectancy gains. Wilkinson (1996) further stated that there is a direct relationship between health and income of the people at minimum level and there is no consistent relationship between them. Sauvaget *et al*., (2011) also states that higher education develops people's capacity to upsurge their sagacity of personal control, mastery, and self-direction. People with high levels of personal control are more knowledgeable about health and they are more likely to avoid an unhealthy lifestyle.

In a study conducted in Nigeria, Sede and Ohemeng (2015) investigated the socioeconomic determinants of life expectancy and concluded that the socioeconomic determinants accounted for 90% increase in life expectancy given a lag of up to three years. Rogers and Wofford (1989) found that urbanization, agriculture-related population, illiteracy rate, access to drinking water, average calorie per person and doctor per population play an important role in the determination of life expectancy for developing nations.

In summary, the authors under this objective share a lot of similarities; their study is based on most of the variables under study in this study. To mention a few, their arguments are related to health expenditures, education attainments that can be linked to government expenditure because if the government would not spend on education only a few people will be able to live up to the expected number of years as most of the people will be illiterate and die young.

Differences

According to Sen (1999), education is an imperative determinant of life expectancy. Mahfuz (2008) in argued that a primary health care program can be referred as an important determinant of life expectancy. On the base of the study, Mahfuz (2008) determined that there is a positive relationship between primary health care expenditures and health status. At adult age, the high death rates have been associated with heart related diseases.

Magadi (1997) reports that in the Kenyan communities it's mostly father's education that is significantly associated with improving a child health and that of the entire household not the mother's education. This is because of the socio-cultural behaviors maintained in Kenya where a woman has a low status than the male and must stick to working in environments where their status will be kept low than males.

Sauvaget *et al*., (2011) and Ali and Ahmad (2014) share similar but different opinions on how life expectancy can improve. Sauvaget *et al*., (2011) state that developments in disease prevention, nutritional intake, level of education, living and working conditions have resulted in a better quality of life worldwide. Ali and Ahmad (2014) further argue that an increase in per capita income and changing the expenditure structure in developing countries could have a positive impact on life expectancy. The mentioned authors share the same goal but their method or strategy to their end goal is different. These authors are all in the mindset of improving life expectancy.

Evaluations

This literature provides us with information onto how the socioeconomic variables under study impact South African life expectancy, with the health policies stated showcasing the direction into which there's still an area for improvement in meeting the health policy goals. It is evident from the above literature that life expectancy is used as a health development measurement and not studied separately to gain other hinders. From the above literature writers share different opinions based on facts. It is apparent from the literature that in most studies an improvement in education and health care centers would mean an improvement in life expectancy. Most authors have highlighted the importance of education, as a result death was due to being illiterate and due to the lack of health resource. In simple terms, linking the above literature with the variables under study, government needs to spend more on education and health to improve the GDP per capita of the country. It is evident that most people do not live up until their expected years due to the lack of fundamental resources mentioned. There is a significant relationship between life expectancy, the GDP per capita, education expenditure and health expenditure from the above literature.

Gaps

From this literature it is evident that life expectancy in South Africa has not been examined thoroughly, through determining how each socioeconomic variable impact life expectancy. From the above literature life expectancy is mentioned as a key term when studying health. This literature is based mostly in education, health and economic factors that determine longevity. Minimum research has been conducted on how the countries fertility, undernourishment and access to sustainable drinking water impact life expectancy and health policies.

2.3.2 Objective two: to investigate the causality relationship between life expectancy and socioeconomic variables

Salient Points

According to Bidzha, Greyling and Mahabir (2017) the GDP per capita is statistically significant at 10% level of significance and this means that a 1% increase in GDP per capita will on average, result in improvement in life expectancy by 0,2% holding other influences constant. Bicuinaite (2014) indicates that there has been a sequential significant relationship between food prices and mortality. Keita (2013) states that Rogers (1979) noticed that life expectancy rises at a weakening rate as there is an increase in income. Grossman (1972) stated that price increases have a negative relationship with life expectancy; thus, inflation disturbs a household's wellbeing. Higher wages do not always pilot to higher life expectancy (Bicuinaite, 2014).Hoi *et al*, (2009) contend that disparities in income and education were as of late found to represent local imbalances in life expectancy and other wellbeing markers.

Life expectancy also has an influential determiner that is education and the expected years for survival differ in relation to an individual's level of education (Keita, 2013).Williamson and Boehmer (1997) mentioned on Ali and Ahmad (2014) study states that education have an impact on health in two ways as education enhances the productivity of labor which increases income and improves the livelihood of people. Keita (2013) argued that country prosperity is one of the most discussed health causal factors. The prosperity of a country has evidently a sturdy relationship with health and the absolute level of income which is measured per capita GDP. Anand and Ravalian (1993) investigated that there is a positive significant relationship between life expectancy and per capita GNP, but it works through national income and public expenditure on health.

The socio-economic inputs such as public health expenditure, income (GDP) and level of education do not directly impact health outcomes but indirectly through proximate determinants (Bidzha, Greyling & Mahabir, 2017). Bidzha, Greyling and Mahabir, (2017) further explains the above by stating that public expenditure on health provide resources for the purchase of vaccines while the literacy level of the mother may assist with correct usage of the prescribed medication leading to better health outcomes. Public health expenditure per capita as the main descriptive variable is statistically not significant to life expectancy even though it has an expected significant role (Bidzha, Greyling & Mahabir, 2017). Pritchett (1997) have expressed empirical evidence that suggests that the government expenditure on health is not the main drive behind mortality rates, but rather the per capita income and inequality.

Similarities

Authors like Bidzha, Greyling and Mahabir (2017) and Keita (2013) argued that GDP per capita have a causal relationship with life expectancy. However, Grossman (1972) explanation stated that price increases have a negative relationship with life expectancy; thus, inflation disturbs a household's wellbeing. Similarly, Bicuinaite (2014) indicated that there has been a sequential significant relationship between food prices and mortality. Education has also been indicated to have a significant relationship with life expectancy. Life expectancy also has an influential determiner that is education and the expected years for survival differ in relation to an individual's level of education (Keita, 2013).Williamson and Boehmer (1997) mentioned on Ali and Ahmad (2014) study states that education have an impact on health in two ways as education enhances the productivity of labor which increases income and improves the livelihood of people.

Differences

Public health expenditure per capita as the main descriptive variable is statistically not significant to life expectancy although it has an expected sign (Bidzha, Greyling & Mahabir, 2017). Pritchett (1997) have expressed empirical evidence that suggests that the government expenditure on health is not the main drive behind mortality rates, but rather the per capita income and inequality. Kalediene and Petrauskiene (2000) investigated that in both developed and developing countries, urbanization is one of the most significant indicators of life expectancy. In urban areas there are better education facilities, better medical cares and improvements in the socioeconomic infrastructure and this has a positive impact on health

(Kalediene & Petrauskiene, 2000). The better resources available cause disparities between living standards between rural and urban areas. The urban resources are the pull factors pulling people living in rural areas to come and benefit from the better living conditions in urban areas thus in some areas in urban areas there are underdevelopments leading to the inability of providing them with certain basic resources.

Macfarlane *et al.,* (2000) stated that access to sustainable safe drinking water isa significant determiner of life expectancy in the developing countries. On the bases of cross-country analysis, Hitiris and Posnet (1992) found that there is the negative association between primary health care spending and child mortality rates. On the contrary, Anand and Ravalian (1993) investigated that there is a positive important relationship between life expectancy and per capita GNP, but it works through GDP per capita income and public expenditure on health. Anand and Ravalian (1993) further state that when public expenditures on health and poverty are used as independent variables with per capita GNP the results are contrary to the first model. The contrary between Hitris and Posnet (1992) and Anand and Ravalian (1993) empirics can be further explained by taking note that both these variables are posed to different people belonging to different Gini coefficients, so there are candidates likely to live to the first world life expectancies because of access to first-rate health care facilities, food, and shelter.

Evaluation

From the literature above it became evident that the causality relationship between socioeconomic variables and life expectancy is different for different researchers. Granger causality provides us with a clear understanding of causality by stating that variables x is said to granger cause variable y if variable y granger causes variable x. For most of the variables under study, the literature showcased a unidirectional relationship between variables, the relationship was not bi-directional. It is evident from the literature that socioeconomic variables have a causality relationship in life expectancy.

Gaps

The South African causality relationship between socioeconomic variables and life expectancy needs to be studied further. This literature had a minimum evidence on the reality of what causes life expectancy to decline when studying life expectancy using the variables under this research. It is not evident fully according to the definition of granger causality as to how these variables granger cause each other.

2.3.3 Objective three: to examine the differentials between males and females on life expectancy

Salient Points

Murphy and Topel, (2006) states that life expectancy in developed countries is higher at birth for women than it is for men. In developing countries, it is also evident that life expectancy for female is higher than the life expectancy of males. Ehiemua, (2014) argued that the disparity in life expectancy between males and females have occurred since the 20th century with females with the higher life expectancy. Men have smaller health reserves, mostly at birth. Secondly, the inequality could be because of the different roles men and women play in society. Women in societies play a role of nurture while males must hunt for food travelling long distances at risky environments but because they are male it is safe that they do that rather than females. The mentioned reasons are socio-cultural. Studies show that life expectancy in developed countries is lower in the male gender at birth than for females (Murphy & Topel, 2006). The first reason that is given is the physical differences between males and females (Faulds *et al*., 2012).

Similarities

Ehiemua, (2014) state's that female life expectancy has been higher since the 20th century. Faulds *et al*., (2012) stated that the difference in life expectancy is due to the obvious which is the physical differences between males and females. Men are considered to have a physical advantage over women because they are stronger, taller and less overweight, however, none of these qualities guarantees them the expected long life (Drevenstedt *et al*., 2008). The abolition of shortage of food is the most thoughtful challenge facing South Africa today. Poverty mostly strike household headed by women, from the young to the elderly mostly in rural areas than urban areas.

Differences

From the above literature men are said to have lower life expectancy than females (Ehiemua, 2014), even though males are considered to have a physical advantage due to the physical appearance and the belief that they are stronger (Drevenstedt *et al*., 2008). Faulds *et al*., (2012), states that men are three times more likely to die than females. Waldron (1995) analysis on the difference between males and females identifies their biological factor as what differentiate their life expectancy; women's sex hormones are indicated to have an ability to reduce the risk for being infected by diseases because of the special effect they contain on their serum lipids. Men's testosterone level cause uncomfortable effects on their serum lipids, their hormones cannot fight diseases as effective as those serum lipids for females (Faulds *et al*., 2012). Male's accretion of abdominal body fat ratio is another contributing variable to the coronary illness. Deaths are also caused by the reckless behavior males and females have which include how they perceive as a risky lifestyle. Most deaths are associated with car accidents, homicides, suicide, cancer and drowning especially for men at their millennial ages. The gender disparity is reportedly linked more with coronary diseases. Men are said to be at heart related risk at the age of 40 years while females are only at risk after reaching menopause (Action on Smoking and Health, 2013). The gender dissimilarities have been linked with high death rates from accidents at young ages (Longevity Science Advisory Panel, 2012).

Ehiemua (2014), states that women have always had the higher life expectancy than men since the 20th century. The first reason that was provided was the physical differences between males and females, males tend to work in environments like factories where hard and heavy products must be lifted, and females mostly work in offices where they will not have to lift any heavy objects (Faulds *et al*., 2012). This justifies why their life expectancy differ, overworking your body can have an effect at the later stage of your life.

Evaluation

It is clear from the literature above that females have a higher life expectancy compared to males. The difference in life expectancy between these two genders has been explained and linked to an individual's physical appearance. Most publishers emphasized the difference in the type of labor for females and males to have an impact in the difference between these two genders. From the above literature writers showcase different view onto factors influencing the differences in male and female life expectancy.

Gaps

From the above literature the stereotypes linked to each gender where not mentioned as factors that might have an impact in the difference between males and female's life expectancy in South Africa. The literature lacks an explanation on socio-cultural variations having an impact in male and female life expectancy disparities.

2.3.4 Gaps identified

1. From previous studies, minimum research has been done to explore the socioeconomic determinants of life expectancy during the post-apartheid in South Africa. Most of the researchers that I came across focuses on HIV/AIDS as the main determiner of life expectancy with variables like income, health and education as substituting variables to HIV/Aids.

2. The previous researchers on South African life expectancy do not share the same objectives stated on this thesis; this thesis aims to contribute towards filling this gap.

CHAPTER THREE: Theoretical framework and Conceptual design

3.1 Theoretical Framework

Dynamic equilibrium

Graham *et al*, (2008) state that there are three wide circumstances that have been identified as course of mortality and morbidity in developed countries. Graham *et al*., (2008) states that the theory of population health change was proposed by Manton (1980) who combined fundamentals of both the compression and expansion theories into a scenario he termed "dynamic equilibrium". Manton (1980) studied mortality reductions as at least partly, the result of reductions in the rate of chronic disease development. This theory offers an alternative view of the fundamental process behind delaying death through delays in chronic diseases by emphasizing the importance of delaying the intermediate stage of a disease process. Increasing medical advances and educating people about the importance of living a healthier lifestyle from the early ages would decrease morbidity and increase life expectancy. This theory is based under the assumption that every individual will respond the same way to treatments in the intermediate stage and people will be able to live longer due to delay on the onset of diseases.

Morbidity expansion

Gruenberg (2005) and Kramer (1980) suggest that a decline in future mortality will be achievable through developments in medical care and secondary prevention strategies. These secondary strategies will enhance the life of people with underlying degenerative diseases. The expansion of morbidity theory states that if enhancements in life expectancy are motivated mainly by cumulative competences of medicine to prevent deadly outcomes from degenerative diseases, and the fundamental of patterns of diseases remain basically unaffected, there will be an expansion of morbidity as the rate into which people die will continue to fall. When explaining this theory further, medical advances will limit death rate. The expansion of morbidity will decrease the mortality rate as people who would have assumable died due to chronic illnesses and diseases will now be surviving for longer periods. People will be surviving for longer periods with the degenerative diseases with the period into which these people spend being chronically ill and disabled increasing at the end of life. This theory assumes that the underlying research of the causes and effects of these degenerative diseases is meticulously related to the ageing process in a way that it would persist obstinately resilient to the finest efforts of medical technology and developments in public health. These theory bases its arguments mostly on government health expenditure as health improvement which may help in advancing medical facilities are government duties when spending on health. The way of increasing life expectancy according to this theory is through medical advances, total fertility rate would decrease and the importance of providing people with sustainable and clean drinking water, risks of undernourishments would be emphasized to South Africans through education if government would spend more on health. An increase in health expenditure will hypothetically expand the morbidity thus increasing South African life expectancy.

<u>Compression morbidity</u>

Fries (1980) based this theory on evidence of postponements in the beginning of chronic diseases and a data that suggested a slowdown in rates into which life expectancy increases mostly for women. This theory suggests that an upsurge in life expectancy is mostly determined by the vicissitudes in the fundamental pattern of diseases. People will start living longer as the beginning of chronic diseases will be deferred to later ages. This theory indicates that the period into which people spend in a state of chronic diseases will contract and the general health developments will lead to an increase in life expectancy with the impacts of health developments diminishing as human longevity approaches its natural limits. This theory is based under the assumption that compressing of morbidity will work for everyone. Morbidity can be compressed by living a healthier lifestyle prior, during the millennial ages to delay sickness that were assumable to attack you as an individual when you are older. In South Africa we can compress morbidity through prevention of diseases at the early stages of life. This can be done by educating people on what is expected of them once they reach a hypothetical age. In explaining this theory further, the government needs to invest more on health and educating people on ways to compress morbidity.

<u>Epidemiological transition</u>

Another theoretical framework is the epidemiologic transition which was proposed by Omran. According to Omran (2005), there are two major mechanisms of the transition: the first one is changing in population development routes and arrangement, especially in the age distribution from younger to older. The second mechanism is the change in patterns of mortality, this includes an increase in life expectancy and rationalizing of the significant different causes of premature deaths which may be more important in the fluctuating life expectancy. This theory of epidemiologic transition places its focus on the complexities of changes in patterns of health and diseases. The term "epidemiologic transition" raises the question of what the main drive behind the fluctuation of life expectancies is. This theory looks at the factors that may put one's health at risk such as economic, demographic, and sociologic factors. When explaining this theory in the context of this research, we can explain epidemiologic transition as a theory that places its focus on socioeconomic variables as determiners of life expectancy. It places into consideration that other variables from the socioeconomic variables have a viable role in life expectancy. This theory explains life expectancy well as it understands that people die young or older due to a numerous cause of death. Being unemployed and being unable to receive the best public health because of economic issues may be a determiner for a decreased life expectancy for instance.

Omran's theory is explained using three transitions; the first transition is called the Age of Pestilence and Famine. This transition comprises of high and fluctuating mortality rates, a low average of life expectancy and periods of population growth that are not constant. This change in pattern is explained to have occurred pre-history as people where transformed from being hunter gatherers to agricultural societies. The migrations led to new ecological imbalances, infectious diseases increased as the environment was now contaminated with human and animal waste. Malnutrition and famine became evident as food was less diverse and people started to be ill due to insufficient food; an increased population density led to an increase in endemic diseases and transmission rates. This first stage of transition can be explained in terms of this research as a stage whereby undernourishment is evident, with a less expenditure on health. People therefore will die with an increase in birth rate as their fertility rate is not contained due to lack of education and in some instances high birth rate occurs as some sort of protection due to high rate in mortality.

The second transition phase is defined as the Age of Receding Pandemics, at this stage steeper mortality rates decline with an increase in the average life expectancy and more sustained population growth. In this phase a shift in disease pattern occur from primary diseases that were infectious to chronic diseases. The changes that occur under this phase are regarded as multi-faceted and complex because new developments start occurring. Changes occur in the environment, there are also socioeconomic changes, political and cultural changes; living conditions improve including the contributions of hygienic movement to water and hygienic services, the nutrition starts improving, medical and public health advances become evident, people understand infectious diseases better, fertility rate drops, under five mortality declines and the life span increases resulting in an older population. At this stage, education is prominent as people start understanding the infectious disease, improvements in health services lead to a decline in infant mortality rates, fertility rate and life expectancy improves. It is evident that the socioeconomic changes that occur at this stage also bring to an increase in life span with a population filled with people of older ages, thus this is the best theory to use in justifying life expectancy as it shows the relationship between socioeconomic variables and life expectancy improvements.

The third transition phase is called the Age of degenerative and Man-Made Diseases whereby infectious disease pandemics are replaced by major causes of death, the degenerative diseases. Anthropogenic causes replace infectious diseases as major contributors to morbidity and mortality. Mortality rate declines at this stage with life expectancy increasing to over 50 years with changes in anthropogenic and biological determiners of diseases. Fertility becomes significant to growth in population. At this stage life expectancy increases further due to new developments and technological innovations.

Health production function

Health production comprises of inputs and outputs, the inputs of health status are health centers, education, medical and health expenditures; and the outputs are life expectancy or morbidi**ty**. Inputs in this theory are indicated as factors that lead to either an increase or decrease in life expectancy which when basing the theory in the study these can be the independent variables (socioeconomic factors), the production can be referred to as the process into which fluctuation occurs due to the impact that the socioeconomic variables have on life expectancy. The output can then be described as the outcome from the socioeconomic variables. Given basic resources an individual need to survive the output can either be survival or death depending on an individual's immune system but when we base the argument under the assumption that the immune system will consume every resource the same way there would not be deaths occurring this therefore means an increase in life expectancy would occur and vice versa.

Demographic transition

Demographic transition studies life expectancy using a population cycle that includes birth and death as fundamental consequences in population growth rate. This theory provides us with an understanding of what brings change in birth and death rate. Change in birth and death rate according to the demographic transition occurs with change in a country's economic development and a country must pass through different stages of population growth. The demographic transition is explained using four stages. The first stage comprises of high population growth potential, this stage has a fluctuating high birth and death rate and, in most cases, can be compared to circumstances into which people living in underdeveloped rural areas live beneath because of the high dependence in agriculture as a source of sustaining life with a few or no means of transport, commerce or insurance and medical facilities. People living in such circumstances have low to no income and are underfed to the level of poverty.

The second stage which is described as the population explosion stage occurs when there is a decline in death rate in communities with an increase in agricultural production, people being more educated, quality of food and an improvement in medical and health facilities. This is the stage whereby economic development occurs as government efforts are clear to everyone and individuals start investing in the importance of their lives. The population stage which is the third stage comprises of a decline in birth rate as death rate continues to decrease, this can be identified as a deteriorating rate. Population grows faster, and family planning methods are thoroughly explained to individual thus there is a decline in birth rate caused by changing social attitudes. At the fourth stage the population is stationary. Both birth and death rate are close to being equal.

When applying this theory in South African life expectancy it can be argued that South Africa was at first at the second stage of demographic transition. This is evident at the level into which the life expectancy trend has occurred. South African life expectancy was high by 62 years in 1994 and declined to 52 years in 2004, remained stationary from 2004 to 2007 and this stage can be referred to the stationary stage where birth and death were close to being equal, after 2007 life expectancy exploded in this stage, death rate declined with an increase in production. The South African trend when it comes to life expectancy is not growing as according to the demographic transition so as South African population growth. This theory explains population change in size according to stages which are easily met in certain countries as their trend in population size can be explained in the manner explained in this theory.

From the above theories the *epidemiologic transition* is the theory that is compatible in explaining life expectancy as it takes into consideration the socioeconomic factors that contribute to a decline or increase in life expectancy. As stated in the above paragraphs, the theory of *epidemiologic transition* focuses on the complex change in patterns of health and disease. The term “epidemiologic transition” raises a question of what the main drive behind the fluctuation of life expectancy is. This theory looks at the factors that may place one’s health at risk such as socioeconomic factors. Both the health production and epidemiologic transition are better at explaining life expectancy as they both place emphasis on socioeconomic factors playing a major role in either an increase or decrease in life expectancy. The theories mentioned above proclaim the same role which is improving life expectancy using different dynamics. Dynamic equilibrium which constitute of both expansion and compression of morbidity places its focus on healthy methods into which there can be a decline in morbidity. Dynamic equilibrium explains its theory by stating that by delaying the onset of chronic diseases and eliminating deadly disorders will thus lead to an increase in life expectancy. This theory bases its arguments on medical advances that would decrease chronic illness. Health expenditure can be used to explain this theory, advances in the manner into which governments spend on health can expand morbidity through medical advances, increase in health care's, increase in the number of physicians at a later stage compressing morbidity by delaying the onset of chronic diseases.

Health production studies life expectancy by focusing on the inputs and outputs which can be explained as the causes, solution and the outcome. Socioeconomic variables can be considered as inputs when explaining life expectancy as life expectancy is dependent on these variables to either increase or decrease. The health production is the section into which these variables function in either improving or decreasing life expectancy, the process that partakes to an increase or decrease in life expectancy. Demographic and epidemiologic transition are similar in explanation but differ as demographic transition focus on fertility rates and mortality rates when studying the patterns of population growth with epidemiologic transition focusing on in-depth causes of deaths, identifying whether the death was a naturally caused or due to an infectious disease. *Epidemiologic transition* explains the study better than the afore mentioned theories as it studies life expectancy by focusing on what may be causing a decrease or increase in life expectancy, the impact each variable might have on life expectancy and health policies and thus later providing explanation on to how males and females life expectancy differ by studying both genders according to ailments that may hinder both genders differently. This theory also justifies an increase or decrease in life expectancy by including the socioeconomic changes that occur thus improving life expectancy.

Table 3,1: Life expectancy Theories 1

s/n	Theory	Key variables	Measurable indicator	Claimed causality or association

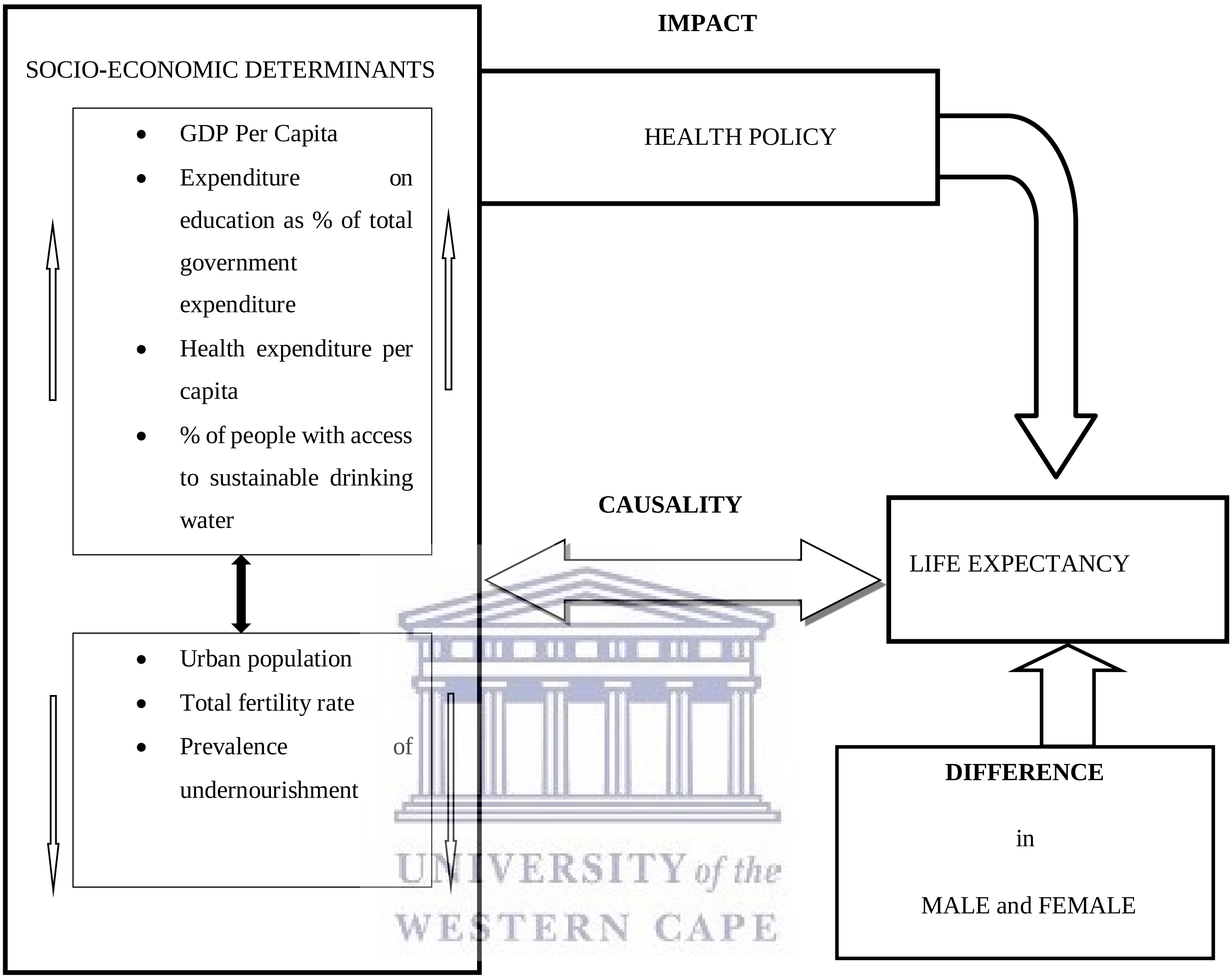
1	Compression Morbidity	Diseases, life expectancy,	Delays in onset of chronic disease, increasing life expectancy	compress the time horizon between the onset of chronic illness or disability and the time in which a person dies.
2	Dynamic equilibrium	Medical advances, socioeconomic variables, life expectancy	Delays in onset of chronic disease, increasing life expectancy, medical advances, socioeconomic variables	Dynamic equilibrium between the onset of chronic illness and the availability of medical advances
3	Morbidity expansion	Medical advances, socioeconomic variables	Medical advances, socioeconomic variables	Increase in the number of years of life and the proportion of disability by the elimination of a fatal disorder, such as cancer or heart disease.
4	Epidemiologic transition	Socioeconomic factors, life expectancy	Mortality change in population growth and composition, health risk, socioeconomic factors	Change in population growth is studied by evaluating the causes of death

5	Health production function	Socioeconomic variables	Comprises of inputs and outputs, the inputs of health status are health centers, education, medical and health expenditure whereas the output is life expectancy or morbidity	Improvement in life expectancy occurs with an improvement in socioeconomic variables.
6	Demographic transition	Birth rate, death rate, growth rate of population	Fall in death rate continuing with a rapid population growth and later concluding with a decline in birth rate	This theory places its focus on changes in birth rate and death rate as a consequences of growth rate population

Source: Authors computation

3.2Conceptual design

Figure 3,2: SED of life expectancy



Source: Authors Computation

Figure 3,2, the assortment into which life expectancy can either increase or decrease is evident. The socioeconomic determinants under study play a major role in either increasing or decreasing life expectancy. An increase in GDP per capita, expenditure on education as percentage of total government, health expenditure and percentage of people with access to sustainable water would be an increase in South African life expectancy. A balanced population size both urban and rural areas would bring to a steady influx on life expectancy. Decentralization of resources in urban areas would limit the need from people to be around this area.

Decreasing the number of urban dwellers in South Africa would encourage an increase in life expectancy. This is because some individuals live in toxic outskirts where water is not accessible, electricity with undernourishment prevailing. In most of these outskirts (informal areas), land for agricultural basis is limited if not unavailable compared to the availability of land for agriculture in rural areas. A decline in population size would mean an increase in life expectancy. Total fertility is defined as the number of births a woman of hypothetical cohort would be able to bear throughout their life at the rates specified by the ASFR for a year if none of them dies before crossing the age of production. An increase in total fertility rate describes how good that population can be, but an increase in total fertility rate can again mean more children given birth to and an increase to the population size of a specific country. A decline or a restricted number of children per person would lead to a smaller number of possible deaths as an individual would give birth to a sustainable number of children rather than giving birth to a numerous number of children for security hoping the fittest will survive. A decrease in undernourishment would lead to an increase in life expectancy.

CHAPTER FOUR: Methodology

4.1RESEARCH DESIGN

The study covers the period 1994-2016 (22years), interpolated into four quarters of the year to provide an adequate amount of freedom to capture, a significantly outsized amount of the effect of socio-economic variables on South African life expectancy over time. Due to this data being a time series data, it had to be tested for stationarity. Testing for stationarity is useful because the regression of a non-stationary series on another may provide bogus results. Running a data that is non-stationary provides parameter estimates from the regression that are biased and unreliable (Engle & Grange). A time series analysis is a new method of data analysis that is appropriate for a longitudinal data. In this study, the Augmented Dickey-Fuller tests have been used for testing the unit root. In explaining the long run relationship among the variables under investigation the Johansen co-integration test is employed. The Johansen co-integration test must be significant in this study because of its implications that represent the convergence between the variables.

When variables cointegrate the vector error correction (VEC) model is conducted. In this study the VAR was tested but because there was cointegration between variables the vector error correction model was conducted and is the main result for interpreting objective 1. A vector auto-regression (VAR) is employed because it allows a variable to be regressed on its own lag and lags of other variables (Todd 1990). The VAR allows each variable to be affected by its own history and the history of other variables to minimize the problem of simultaneity (Kretzmer, 1992).As the variables indicated stationarity in the unit root test, the parameters need to be estimated to ascertain the relative impact of each variable on life expectancy. The granger causality test is employed for explaining objective 2. The granger causality test is conducted to determine whether socio-economic variables have a unidirectional or bidirectional relationship with life expectancy. The direction of causality is determined through an indication of causality or no causal direction between life expectancy and the socioeconomic variables. The independent test was used to identify the difference between male and female life expectancy. Econometric views (E-Views) and the statistical package for social sciences (SPSS) are the software tools used to analyze the secondary data that was extracted from World bank. The secondary data is from 1994 – 2016, it is a yearly data which was converted to quarters.

4.2 MODEL SPECIFICATION

Augmented Dickey Fuller (ADF)

A unit root test is a statistical tool used for testing stationarity and comprises of an augmented dickey fuller. An augmented dickey fuller, tests the null hypothesis that a unit root is present in a time series. Dickey and Fuller (1979) states that a statistic does not follow a conventional t-distribution under the null hypothesis of a unit root test, asymptotic results are derived, and critical values are simulated for numerous tests and sample sizes.

Johansen co-integration

Johansen (1995) indicated that it is not much of a necessity to pre-test variables to establish their order of integration. In this study the Johansen co-integration test was conducted when all variables in a series were differenced with stationary variables. Stationary variables are then tested to determine whether there is a long or short run relationship between variables. When running the co-integration test; if co-integration is detected, the Vector Error Correction (VEC) model may be used to estimate the co-integrating equation and if co-integration is not detected, the Vector Autoregressive (VAR) must be conducted.

Granger Causality Test

The Granger (1969) approach is used to question whether each variable granger causes another variable. A variable is indicated to granger cause another variable if the variable helps in predicting another variable or if the coefficient statistically significant.

Independent t-test

This test is used to compare mean scores of two different groups. This test is used to test the significant difference between two mean scores for males and females. For the test to be successful, there should be a dependent variable, one variable should be categorical, and the other variable should be continuous. The independent t-test provides with information on whether the significant difference occurs between males and females mean scores.

4.2.1 Objective 1: to determine the impact of socioeconomic variables and health policy efforts on life expectancy

In determining the impact of socioeconomic variables on life expectancy over time, a time series component which is an econometric views tool of analysis is used. This is a type of a software tool that comprises of a collection of well-defined data items obtained through repeated measurements over time. Measuring the impact of socioeconomic variables on life expectancy is conducted from the year 1994 – 2016.This is a clear illustration of a time series data. Before proceeding to other tools of analysis, an investigation of whether the data is stationary or not stationary is done to avoid the spuriousness of results that may occur due to the non- stationary data regressed.

Unit root test was used for testing whether the data is stationary or not stationary because this tool is the formal method for testing stationarity. It is important to check if the series is stationary or not stationary before using it in regression. A series must go through several differencing operations also known as the order of integration in order to make the series stationary and this is denoted as I (d) where d is the order of integration.

Perron *et al*., (1992) states that "a popular example of a non-stationary series is the *random walk*:

$$y_t = y_{t-1} + \epsilon_t$$

Where ϵ is defined as a stationary random disturbance term. The series y has a constant forecast value, conditional on t, and the variance is increasing over time. The random walk is a difference stationary series since the first difference of y is stationary:"

$$y_t - y_{t-1} = (1 - L)y_t = \epsilon_t$$

Augmented Dicker Fuller (ADF) was the basic form of unit root test chosen from the six forms of testing a unit root which are the PP, DFLGS, KPSS, ERS, and NP. After choosing to run an ADF test, the following step done was to examine whether the statistics is stationary to at level, 1st difference or 2nd difference and stationarity becomes evident when running the results using the exogenous regressors; constant, trend and constant or neither. Before performing the co-integration test and Vector error correction (VEC) model, determining the optimal number of lags had to be done as they eliminate residual autocorrelation. The lag length criteria, therefore, took us to the next step which was the Johansen co-integration test. When running this test, the trace and the maximum eigen value test determined if there was co-integration at 0,05 levels. The cointegration test, tests the long run relationship between the socioeconomic variables and life expectancy.

The Johannes co-integration test is useful in this study as it is a procedure for testing several co-integrations. This test is important because variables that fail to converge in the long run may be hazardous to health policy making. The VAR or the VEC model is resolute by co-integrating equations. Vector auto regression (VAR) method must be conducted if variables do not co-integrate and if there is co-integration in variables vector error correction (VEC) model is to be conducted; however, under this study both models are conducted with the vector error correction model providing the study with substantial findings.

4.2.2 Objective 2: to investigate the causality relationship between life expectancy and socioeconomic variables

The causality test was used to determine whether the relationship between socioeconomic variables on life expectancy is statistically significant. For the causality test; if in a time series data, the series is stationary the test is conducted at level values of two or more variables. When the variables are not stationary the test has to be conducted at first or second difference. The lag length criteria can be used for choosing the number of lags before proceeding with running the granger causality test. To balance the results of life expectancy and the stated socioeconomic variables, the Granger causality analysis is used to determine the causality relationship between life expectancy and the socioeconomic variables under study.

A normality test is used to confirm granger causality. The normality test requirements state that the error terms in an observation are normally distributed. Under this test results are shown by means of skewness, kurtosis and Jarque-Bera statistics passing the Chi-square test at 1%.

4.2.3 Objective 3: to examine the differentials between males and females on life expectancy

Using the data derived from the World Bank from (1994 – 2016), the independent t-test was used to justify objective 3. This statistical tool used is a Statistical Package for the Social Sciences (SPSS) statistical tool of analysis. This is a preferred tool of analysis as it compares the means between two unrelated groups on the same continuous dependent variable. EViews was also used as another statistical tool of analysis by using its descriptive statistics to plot a graph, showcasing how significant the difference in life expectancy between males and females is. The Bar graph is used to showcase a clear demonstration of how males differ to females in terms of the expected number of years they can live.

4.3JUSTIFICATION OF VARIABLES

Table 4,3: Variables & Data Source 1

Variable	Description	Sources
LLIFE	Log of life expectancy	World Bank, 2018
LEDUA	Log of Expenditure on education as % of total government expenditure (%)	World bank, 2018
LGDP	Log of GDP per capita, PPP ($)	World bank, 2018
LURBAN	Log of urban population (% of total)	World bank, 2018
LTFR	Log of fertility rate, total (births per woman)	World bank, 2018
LUNOUR	Log of Prevalence of undernourishment (% of population)	World bank, 2018
LPCHE	Log of Health expenditure per capita (current US$)	World bank, 2018
LIWS	Log of percentage of people with access to sustainable drinking water	World bank, 2018

Source: Authors computation

4.3.1 Determinants of life expectancy

Recent studies like the one conducted by Sede and Ohemeng (2015) in Nigeria were dedicated to examining the determinants of life expectancy and considered varied variables like per capita income, health expenditure, literacy, the nominal exchange rate and unemployment rate. In this study variables considered to constitute the socioeconomic variables are: per capita GDP in PPP ($), per capita health expenditure in purchasing power parity (US$), urban population as percentage of total population, total fertility rate, percentage of total population with sustainable access to safe drinking water, undernourished people as percentage of total population and per capita education expenditure.

4.3.2 Life expectancy

Recent studies have indicated the relationship between the economic growth and life expectancy; these studies seek to understand the relationship between life expectancy and economic growth. Biciunaite, (2014) states that the effect of food supply on mortality is the most obvious explanation in explaining the relationship between life expectancy and socioeconomic variables, this relationship has been demonstrated by using the Preston's curve which indicates that people born in wealthy families are expected to live longer on average than people from poor families. In the study conducted in Nigeria, income was described as a determinant of life expectancy. It was recognized that a complete level of income measured by per capita GDP appears to influence mortality significantly as income upsurges from the lowermost to the intermediate range of income bracket, and no additional improvements in life expectancy accompany the increase in income beyond the certain threshold of income bracket.

4.3.3 GDP Per capita

Anand and Ravallion (1993) indicate that there is an evident positive relationship between per capita GDP and life expectancy which is showcased by means of public expenditure on health. As a result, when poverty was introduced according to Anand and Ravallion (1993) to their model, there was no significant relationship between per capita GDP and life expectancy. This therefore can be explained by stating that when a country has a high rate of poverty, chances are there would not be a significant relationship between life expectancy and the per capita GDP. Literacy rate can also be a measurement for a country's GDP per capita rate. Common social virtue, reading and an understanding of health ethics come through when you literate and this has a positive influence in increasing life expectancy. An illiterate person can be referred to a person who cannot read nor write. In South Africa we have approximately five million people who can be distinguished as illiterate.

4.3.4 Government total health expenditure

Total health expenditure is defined as the ratio of total expenditure on public and private health. Expenditure on health services includes preventive and curative, family planning activities, nutritious activities and emergency aid which include the provision of water and sanitation. Total health expenditure can be defined as government expenditure on health-related factors that will result to a positive influence on life expectancy. Spending on health facilities in the outskirts can be considered as a health expenditure as it involves developments and improvements in individual's health.

4.3.5 Access to sustainable water

Access to sustainable water is one of South Africa's MDG's with the number of people without access to sustainable water halved in south Africa. Access to sustainable water has a positive relationship to life expectancy as a few people will die due to diarrhea and other unsafe water diseases that may affect people which might have an impact life expectancy in South Africa.

4.3.6 Government education expenditure

Education can be indicated as a system that can increase an individual's personal sense of control, mastery and self-direction. People who are educated tend to have higher level of personal control which can therefore permit to refrain from living an unhealthy lifestyle. UNICEF(2016) stated that the total government expenditure remained at 17% even thought there were concerns about the lack of growth in educational sectors. The government thus prioritizes early childhood education which might be beneficial in improving life expectancy as basic education might possibly reduce illiteracy rate. Government also prioritizes the national nutrition programs at school; this is beneficial to the country as students get provision to at least one nutritious meal a day thus minimizing the risk for undernourishment. The no fee school allocation and the government support for public schools and infrastructure forms part of the priorities mentioned by the UNICEF (2016), the goal behind this was to provide access to mostly the students from disadvantaged households so that they could get basic education with no fee's payable. If the government would focus on the mentioned priorities, a greater increase in life expectancy in the upcoming years would be evident.

4.3.7 Total fertility rate

Total fertility rate is described as the number of off springs a woman would give birth to if she were to give birth for the rest of her life at rates specified by the ASFR. Census (2011) argued that the total fertility rate for the year 2011 suggested that Limpopo had the highest fertility rate of 3,25 with Western Cape the lowest with 2, 28 and Gauteng with 2,7 among South African provinces.

4.3.8 Prevalence of undernourishment

This concept explains the population nutritional status by showcasing the population whose nutritional consumption is met. Undernourishment has been explained by authors as a lack of security when it comes to food in certain area. When most people in a country are undernourished, this showcases the level of development in a certain country. To eliminate undernourishment the UNICEF (2016) argued that the government has made it a priority to provide the national school nutritional program at school as means of eliminating poverty.

4.3.9 Urban population

The national statistical offices define urban population as a portion of people living in urban areas. This portion of people has access to most resources than people living in rural areas as most developments start at urban areas before they become accessible to rural areas. According to Statista (2018) in 2017 65,78 percent of South Africans total population lived in urban areas and cities.

Chapter Five: Results and Data analysis

5.1Objective 1: To determine the impact of socioeconomic variables and health policy efforts on life expectancy

a) Preliminary results/ tests

Unit root test

Table 5,1: Augmented Dicker Fuller Test

Augmented Dickey-Fuller			
	Trend + intercept		
	Levels	1st Diff	2nd Diff
LLIFE	-8,04*	-0,89	1,81
LEDUA	-1,75	-3,16	-9,15*
LGDP	-0,95	-3,22	-11,98*
LURBAN	-1,74	-2,85	-8,99*
LTFR	1,62	0,53	-10,22*
LUNOUR	-3,69**	-3,22	-5,59*
LPCHE	-2,25	-3,88**	-6,36*
LIWS	2,94	-0,09	-10,79*
*Null hypothesis rejected at 5% **Null hypothesis rejected at 1%			

Source: Authors computation

From the above table5,1 each dimension is conducted with the trend and intercept and at levels, first difference and the second difference. It is evident that some variables are stationary at level; some after first difference and most variables become stationary at the second difference. This can therefore also mean that these variables are integrated into levels I(0), order 1 I(I) and order 2 I(II). LLIFE and LUNOUR became stationary at levels when conducting ADF test, LLIFE rejects the null hypothesis at 5% level of significance and LUNOUR at 1% level of significance. LPCHE is the only variable that passed at 1% level of significance with LEDUA, LGDP, LURBAN, LTFR, LUNOUR, LPCHE, and LIWS becoming passing at the second difference when the trend and intercept are applied in the test equation. When only the intercept is applied in the test equation the results differ. LNOUR rejects the null hypothesis at 1% and under first difference LNOUR again rejects the null hypothesis 1% and LPCHE at 5%. All other variables passed at 5% level of significance when differencing for the second time.

Table 5,1,1: Augmented Dicker Fuller results

	Trend and intercept		
Variable	Level	1st diff.	2nd diff
LE	Y		
EDUA			Y
GDP			Y
TFR			Y
UNOUR	Y		Y
PCHE		Y	
IWS			Y
URBAN			Y

Source: Authors computation

Table 5,1,1 represents a Unit root test for the variables being studied. These variables are distinguished using one and two asterisks to indicate their level of significance. One asterisk represents a null hypothesis rejected at 1% level of significance and two asterisks represent a null hypothesis rejected at 5% level of significance. From the above data, the results show that the null hypothesis for life expectancy is rejected at 5% level of significance when testing stationary under the Augmented Dicker Fuller when testing the unit root test at levels, with the intercept included in the equation. The results for the GDP show that the null hypothesis is rejected at both 5% and 1% level of significance; the Augmented Dicker Fuller is rejected at 5% level of significance when testing the stationarity level for unit root test in 1st difference. For all the other variables the null hypothesis is accepted.

5.1.2 <u>The lag length criteria</u>

Table 5,1,2: VAR lag order Selection Criterion

VAR Lag Order Selection Criteria
Endogenous variables: LLIFE D(LGDP,2) D(LEDUA,2) D(LIWS,2) D(LPCHE) D(LTFR,2) LUNOUR D(LURBAN,2)
Exogenous variables: C
Sample: 1994Q1 2016Q4
Included observations: 82

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2430.884	NA	2.99e-36	-59.09472	-58.85992	-59.00046

1	2845.217	737.7162	5.86e-40	-67.63945	-65.52623	-66.79103
2	3178.525	528.4141	8.58e-43	-74.20792	-70.21629	-72.60534
3	3201.779	32.32910	2.59e-42	-73.21413	-67.34408	-70.85739
4	3416.822	257.0020	8.15e-44	-76.89809	-69.14963	-73.78720
5	3503.703	86.88115	6.98e-44	-77.45617	-67.82929	-73.59112
6	3626.821	99.09531	3.26e-44	-78.89808	-67.39279	-74.27888
7	3664.990	23.27367	1.90e-43	-78.26805	-64.88434	-72.89470
8	4168.567	208.8002*	3.02e-47*	-88.98944*	-73.72732*	-82.86193*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: extracted from EViews by the author

Table 5,1,2 indicates the lag order selected by the criterion. The lag order criterions are minimized for order 8. The lag length selected the all the above criterions, the AIC, SC and the HQ.

5.1.3 Johansen co-integration test

Table 5,1,3,1: Trace Statistics

Sample (adjusted): 1994Q4 2016Q4
Included observations: 89 after adjustments
Trend assumption: Linear deterministic trend
Series: LLIFE LEDUA LGDP LIWS LPCHE LTFR LUNOUR LURBAN
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.613141	255.4273	159.5297	0.0000
At most 1 *	0.379535	170.9045	125.6154	0.0000
At most 2 *	0.324227	128.4261	95.75366	0.0001
At most 3 *	0.300215	93.54708	69.81889	0.0002
At most 4 *	0.254933	61.77565	47.85613	0.0015
At most 5 *	0.211046	35.58461	29.79707	0.0096
At most 6	0.139769	14.48740	15.49471	0.0705
At most 7	0.012151	1.088018	3.841466	0.2969

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Extracted from E-Views by author

Table 5,1,3,1, the trace statistics show that r = 0 of 255,4273exceeds its critical value of 159,5297at 5% level, the null hypothesis of not cointegrating equations is rejected. r= 1 of 170,9045exceeds its critical value of 125,6154, r = 2 of 128,4261also exceed its critical value of 95,75366, r = 3 of 93,54708also exceed its critical value 69,81889, r= 4 of 61,77565also exceeding its critical value of 47,85613 and r=5 of 35,58461also exceeding its critical value of 29,79707. All the explained r values have a p-value which is less than 0,05 we therefore reject the null hypothesis that states that the socioeconomic variables and health policy have no impact on life expectancy and conclude that there is an impact. r =6 of 14,48740is less than the critical value of 15,49471 and r=7 of 1,088018 is less than the critical value of 3,841466 at 5% level of significance thereby failing to reject the null hypothesis of no co-integrating equation. We can conclude that there is a long run relationship between the socioeconomic variables, implementation of health policies and life expectancy.

Table 5,1,3,2: Maximum Eigen Value Statistics

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.613141	84.52279	52.36261	0.0000
At most 1	0.379535	42.47848	46.23142	0.1197
At most 2	0.324227	34.87898	40.07757	0.1716
At most 3	0.300215	31.77144	33.87687	0.0873
At most 4	0.254933	26.19104	27.58434	0.0745
At most 5	0.211046	21.09720	21.13162	0.0506
At most 6	0.139769	13.39938	14.26460	0.0681
At most 7	0.012151	1.088018	3.841466	0.2969

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: extracted from EViews by the author

The maximum Eigenvalue statistics show that at r = 0 of 84,52279exceeds its critical value of 52,36261at 5% level and we reject the null hypothesis of no co-integrating equations. The explained r value has a p-value which is less than 0, 05 level of significance, we therefore reject the null hypothesis that states the socioeconomic variables and health policy have no impact on life expectancy and conclude that there is an impact. r= 1 of 42,47848 is less than its critical value of 46,23142, r = 2 of 34,87898also less than its critical value of 40,07757, r = 3 of 31,77144less than its critical value 33,87687, r = 4 of 26,19104is also less than its critical value of 27,58434and r=5 of 21,09720is less than its critical value of 21,13162, r =6 of 13,39938is less than the critical value of 14,26460and r=7 of 1,088018is less than the critical value of 3,841466at 5% level of significance thereby failing to reject the null hypothesis of no co-integrating equation. The explained r values have a p-value which is more than 0, 05 level of significance, we therefore accept the null hypothesis that states that socioeconomic variables and health policy efforts do not have any significant impact on life expectancy.

Table 5,1,3,3: Trace Statistics and Maximum Eigen Value Statistics

Co-integration results		
Co-integrating Vector (LLIFE, LEDUA, LGDP, LURBAN, LTFR, LUNOUR, LPCHE, LIWS)		
Null Hypothesis	Trace-Statistics	Maximum-Eigen Statistics
None	255,43*	84,52*
At most 1	170,90*	42,48
At most 2	128,43*	34,88
At most 3	93,53*	31,77
At most 4	61,77*	26,19
At most 5	35,58*	21,10
At most 6	14,49	13,40
At most 7	1,09	1,09

*denotes the rejection of hypothesis at the 0.05 level

Source: Author's computation.

From the test statistics of the trace test, results indicate that there are six co-integrating equations at the 5% level of significance and the maximum eigen value test indicates that there is one co-integrating equation as the 5% level of significance. For both results, this, therefore, means that for the trace test rejection of the null hypothesis occurred for six equations and for one equation under the maximum eigen value test.

5.1.4 VECM

b) Main Test Results

Table 5,1,4,1: VECM

variable	coefficient	standard error	t-value
Constant	4.69E-05	5.4E-05	0.87047
LLIFE(-1)	0.672383	0.34622	1.94206
LLIFE(-2)	0.302788	0.34227	0.88464

DD(LEDUA(-1))	0.002550	0.00762	0.33489
DD(LEDUA(-2))	0.000159	0.00643	0.02477
DD(LGDP(-1))	0.003189	0.01267	0.25171
DD(LGDP(-2))	0.001938	0.01218	0.15910
DD(LIWS(-1))	0.041263	0.33018	0.12497
DD(LIWS(-2))	0.038987	0.32763	0.11900
D(LPCHE(-1))	-0.001202	0.00161	-0.74758
D(LPCHE(-2))	-0.001178	0.00165	-0.71493
DD(LTFR(-1))	-0.028972	0.09035	-0.32066
DD(LTFR(-2))	-0.028972	0.04541	-0.77291
LUNOUR(-1)	-0.005499	0.00766	-0.71814
LUNOUR(-2)	-0.005391	0.000809	-0.66633
DD(LURBAN(-1))	-0.008931	0.03764	-0.23728
DD(LURBAN(-2))	-0.005832	0.03743	-0.15582

F-statistic

464.5559

R-squared0.991214

Source: Authors computation

The VECM was conducted to examine both the long run and short-run dynamics of the series. The term error correction relates to the fact that the last period deviation from the long run equilibrium influences the short run dynamics of the dependent variable. Thus, the coefficient of ECT which is the speed of adjustment measures the speed at which variables y returns to equilibrium after the change in x. The previous periods deviation from the long run equilibrium is corrected in the current period as an adjustment speed 0.6% (see appendix). It is evident from the results above that apart from the previous two periods log values of government health expenditure, the previous period of total fertility rate, the previous period undernourishment and the previous period urban population, these variables are not significant in South Africa. A percentage change in the mentioned variables is associated with a percentage decrease in life expectancy. Improvements in terms of government education expenditure, per capita GDP and access to sustainable drinkable water may not lead to higher life expectancy. A percentage change in the mentioned variables is associated with a percentage increase in life expectancy. From the table below (table 5,1,4,2) the coefficient of the co-integrating equation is c(1). From table 5,1,4,2 it is evident that there is a long run relationship between the socioeconomic variables and life expectancy. It became evident when estimating equation that per capita health expenditure, total fertility rate and undernourishment have a significant role in life expectancy.

Table 5,1,4,2: The System of Equation

Dependent Variable: D(LLIFE)
Method: Least Squares
Sample (adjusted): 1995Q1 2016Q4
Included observations: 88 after adjustments
D(LLIFE) = C(1)*(LLIFE(-1) - 0.0997473710346*D(LGDP(-1)) + 0.715553397924*D(LEDUA(-1)) + 5.01471359785*D(LIWS(-1)) - 0.0760273126945*LPCHE(-1) + 4.40118619432*D(LTFR(-1)) - 0.173853732537*LUNOUR(-1) - 1.26619341811*D(LURBAN(-1)) - 3.33202492956) + C(2)*D(LLIFE(-1)) + C(3)*D(LLIFE(-2)) + C(4) *D(LGDP(-1),2) + C(5)*D(LGDP(-2),2) + C(6)*D(LEDUA(-1),2) + C(7) *D(LEDUA(-2),2) + C(8)*D(LIWS(-1),2) + C(9)*D(LIWS(-2),2) + C(10) *D(LPCHE(-1)) + C(11)*D(LPCHE(-2)) + C(12)*D(LTFR(-1),2) + C(13) *D(LTFR(-2),2) + C(14)*D(LUNOUR(-1)) + C(15)*D(LUNOUR(-2)) + C(16)*D(LURBAN(-1),2) + C(17)*D(LURBAN(-2),2) + C(18)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	**-0.006195**	**0.001654**	**-3.744897**	**0.0004**
C(2)	0.672383	0.346222	1.942059	0.0562
C(3)	0.302788	0.342274	0.884636	0.3794
C(4)	0.003189	0.012670	0.251706	0.8020
C(5)	0.001938	0.012179	0.159098	0.8740
C(6)	0.002550	0.007615	0.334889	0.7387
C(7)	0.000159	0.006431	0.024769	0.9803
C(8)	0.041263	0.330181	0.124972	0.9009
C(9)	0.038987	0.327634	0.118996	0.9056
C(10)	-0.001202	0.001607	-0.747583	0.4572
C(11)	-0.001178	0.001648	-0.714934	0.4770
C(12)	-0.028972	0.090351	-0.320662	0.7494
C(13)	-0.035100	0.045413	-0.772906	0.4422
C(14)	-0.005499	0.007658	-0.718136	0.4751
C(15)	-0.005391	0.008090	-0.666332	0.5074
C(16)	-0.008931	0.037638	-0.237284	0.8131
C(17)	-0.005832	0.037429	-0.155817	0.8766
C(18)	4.69E-05	5.39E-05	0.870471	0.3870

R-squared	0.991214	Mean dependent var	2.96E-05
Adjusted R-squared	0.989081	S.D. dependent var	0.004116
S.E. of regression	0.000430	Akaike info criterion	-12.48474
Sum squared resid	1.30E-05	Schwarz criterion	-11.97801
Log likelihood	567.3285	Hannan-Quinn criter.	-12.28059
F-statistic	464.5559	Durbin-Watson stat	2.071514
Prob(F-statistic)	0.000000		

Source: extracted from EViews by the author

C (1) is the row we are particularly interested in because it contains the speed of adjustment which leads towards equilibrium. The value for the speed of adjustment must be negative and statistically significant for it to retain its economic interpretation. The coefficient negative sign indicates that if there is a departure in one direction, the correlation would have to be pulled back in the other direction to maintain equilibrium. The coefficient c (1) in the table above is -0.006195 with the probability of 0.0004. Above 0.61% of departure, in the long run, is corrected. The speed of adjustment is statistically significant meaning the explanatory variables under the study granger cause life expectancy. C (4) and c (17) are short-run coefficients associated that will indicate whether there is a short run relationship. Short run variables will, therefore, provide distinction on whether the variables granger causes life expectancy. The coefficient that is indicated by c(1) is negatively significant and determines that there is a long run relationship between life expectancy and the socioeconomic variables.

Table 5,1,4,3: Wald Test

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.403050	(2, 70)	0.6698
Chi-square	0.806101	2	0.6683

Null Hypothesis: C(4)=C(18)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	0.003189	0.012670
C(18)	4.69E-05	5.39E-05

Restrictions are linear in coefficients.

Source: extracted from EViews by the author

Table 5.1.4.3 shows the Wald test (also called the Wald Chi-Squared Test) which is a way to find out if explanatory variables in a model are significant (Agresti, 1990). Significance in a series occurs when variables add something to the model. Johnson and DiNardo (1997) state that the Wald test works by testing the null hypothesis that a set of parameters is equal to some value. The null hypothesis states that socioeconomic variables and health policy do not have any significance in life expectancy. We, therefore, conclude that we cannot reject the null hypothesis that states that the variables under study do not have any significance in life expectancy. This can also be explained by the 67% level of significance that is greater than the 5% level of significance. Therefore, there is no evidence of a short-run relationship between the variables under study and life expectancy.

Table 5,1,4,4: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.448153	Prob. F(2,68)	0.0375
Obs*R-squared	8.102870	Prob. Chi-Square(2)	0.0174

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 05/21/18 Time: 22:51
Sample: 1995Q1 2016Q4
Included observations: 88
Presample missing value lagged residuals set to zero.

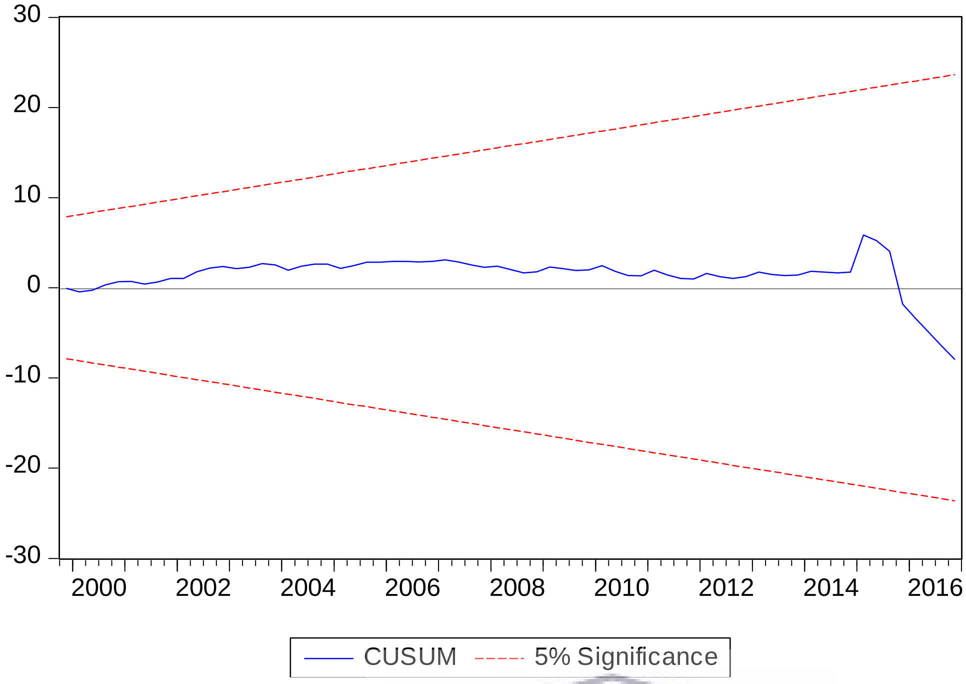
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.002155	0.002966	0.726673	0.4699
C(2)	0.306531	0.630972	0.485807	0.6287
C(3)	-0.297953	0.622277	-0.478811	0.6336
C(4)	0.002794	0.012298	0.227216	0.8209
C(5)	0.003271	0.011956	0.273631	0.7852
C(6)	-0.001405	0.007483	-0.187813	0.8516
C(7)	0.001183	0.006244	0.189480	0.8503
C(8)	-0.053720	0.319876	-0.167940	0.8671
C(9)	-0.076496	0.318165	-0.240428	0.8107
C(10)	0.000447	0.001572	0.284532	0.7769
C(11)	0.001272	0.001745	0.728950	0.4685
C(12)	-0.068341	0.091245	-0.748987	0.4564
C(13)	-0.114394	0.072755	-1.572334	0.1205
C(14)	0.002322	0.007498	0.309699	0.7577
C(15)	0.007078	0.008547	0.828130	0.4105
C(16)	0.004194	0.036507	0.114877	0.9089
C(17)	0.001597	0.036289	0.044016	0.9650
C(18)	2.89E-05	5.75E-05	0.502095	0.6172
RESID(-1)	-0.651890	0.536817	-1.214363	0.2288
RESID(-2)	-0.580523	0.337336	-1.720905	0.0898

R-squared	0.092078	Mean dependent var	-3.15E-19
Adjusted R-squared	-0.161606	S.D. dependent var	0.000386
S.E. of regression	0.000416	Akaike info criterion	-12.53588
Sum squared resid	1.18E-05	Schwarz criterion	-11.97285
Log likelihood	571.5787	Hannan-Quinn criter.	-12.30905
F-statistic	0.362964	Durbin-Watson stat	2.127473
Prob(F-statistic)	0.992004		

Source: extracted from EViews by the author

The null hypothesis states that the is no serial correlation, based on the p-value in the above table, we cannot reject the null hypothesis of this chi-square statistics because the p-value is greater than 5%, in conclusion, there is no evidence of serial correlation which a good result is.

Figure 5,1,4,1: Stability Diagnostic



Source: extracted from EViews by the author

The CUSUM test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. Figure 5.1.4.1 have the blue trend line that lies within the red boundary; the cumulative sum of squares is generally between the 5% significance lines, suggesting that the residual variance is somewhat stable.

c)Confirmatory results

Table 5,1,4,5: VAR Model

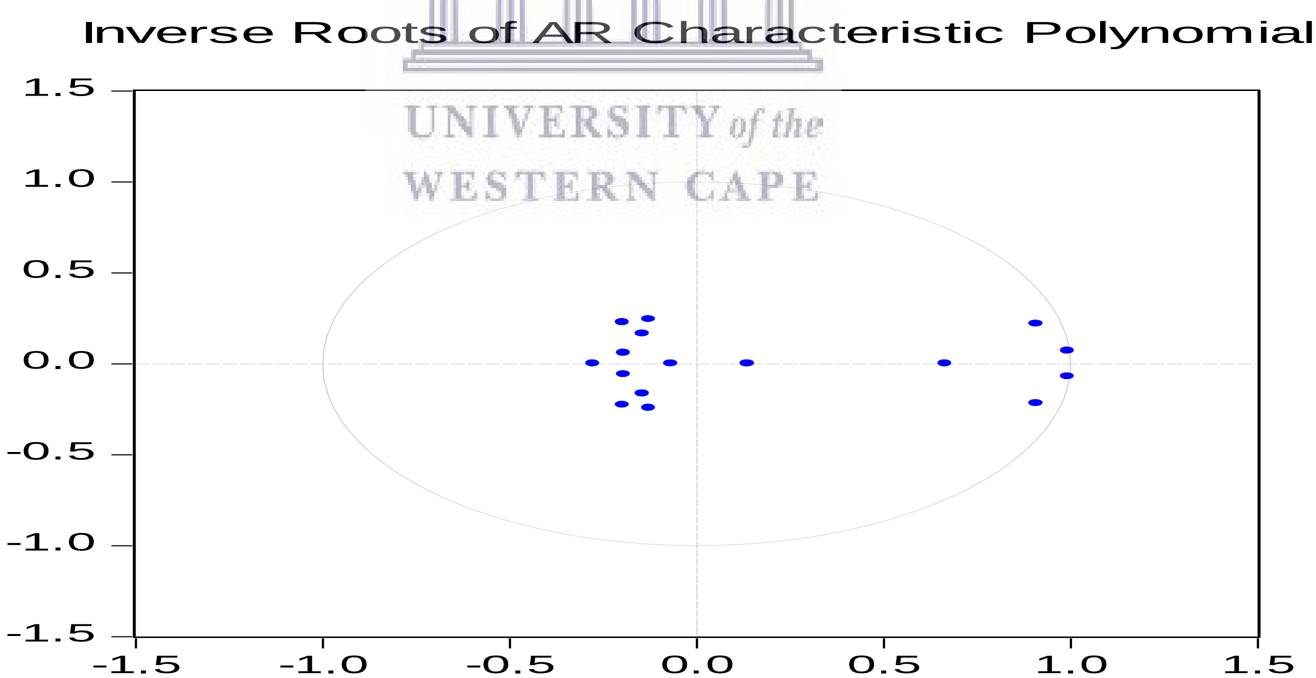
variable	coefficient	standard error	t-value
Constant	0.030513	0.00460	6.63305
LLIFE(-1)	1.969487	0.01324	148.779
LLIFE(-2)	-0.976077	0.01307	-74.7071
DD(LEDUA(-1))	8.74E-05	0.00598	0.01460
DD(LEDUA(-2))	0.000725	0.00591	0.12279
DD(LGDP(-1))	-0.000143	0.01119	-0.01276
DD(LGDP(-2))	0.000752	0.01119	0.06725

DD(LIWS(-1))	0.027112	0.30282	0.08953
DD(LIWS(-2))	0.041501	0.30055	0.13808
D(LPCHE(-1))	-0.000935	0.00148	-0.63324
D(LPCHE(-2))	-0.001175	0.00150	-0.78391
DD(LTFR(-1))	0.057043	0.04372	1.30481
DD(LTFR(-2))	0.000671	0.04253	0.01578
LUNOUR(-1)	-0.003623	0.00331	-1.09296
LUNOUR(-2)	0.000921	0.00356	0.25864
DD(LURBAN(-1))	-0.000332	(0.03448)	-0.00962
DD(LURBAN(-2))	-5.33E-06	(0.03435)	-0.00016

Source: Authors computation

From the above table 5,1,4,5 both dependent and independent variables are used to explain the variables that have a long run or short run relationship with each other. It is striking to notice from the results that the immediate two past periods indicate an increase or decrease of another variable in the past two periods.

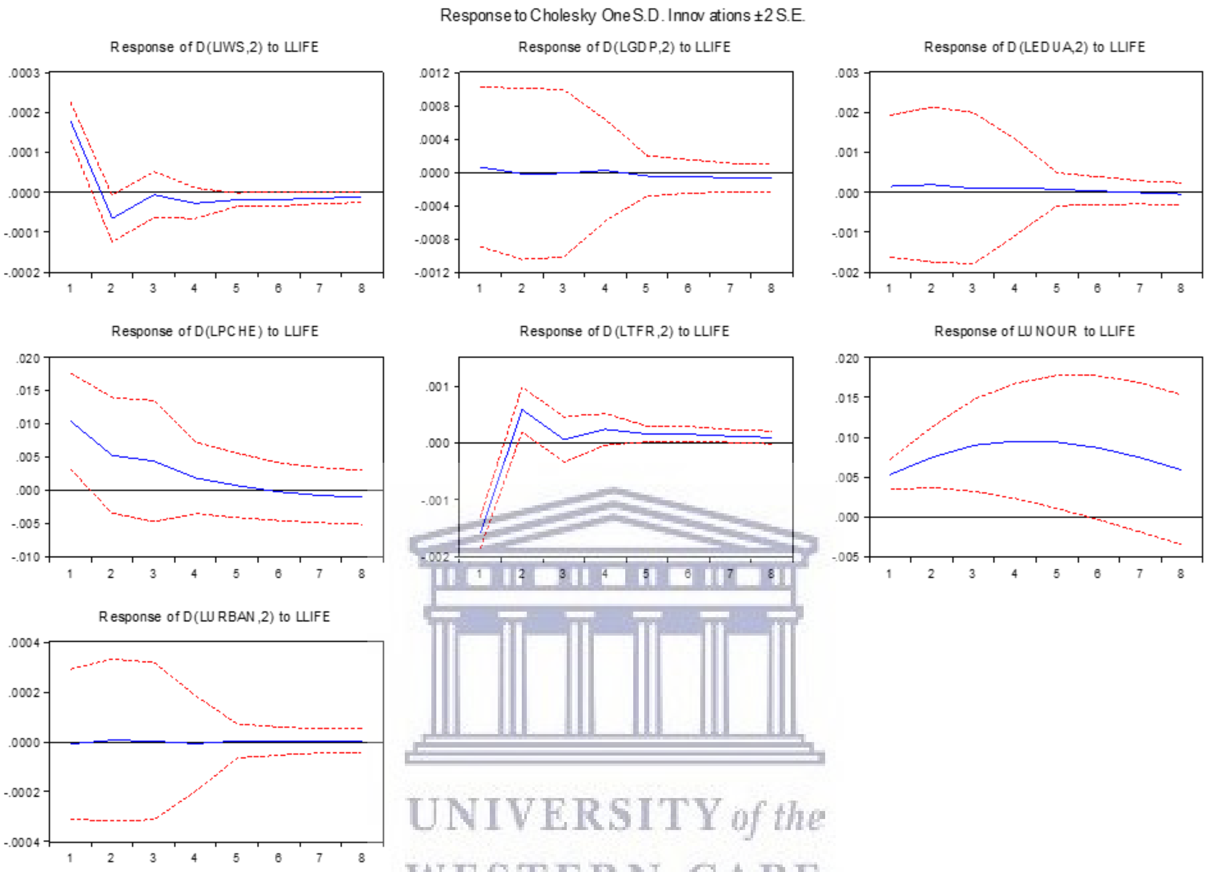
Figure 5,1,4,2: Inverse Root Test



Source: extracted from EViews by the author

From the above diagram no root lies outside the unit circle, the VAR satisfies the stability condition. This implies that the variables under study are stationary under the inverse root test, the manner into which these variables are fluctuate is almost similar.

Figure 5,1,4,3: Impulse response function



Source: extracted from EViews by the author

A one SD shock (innovation) from the response of access to sustainable water (D(LIWS,2)) to life expectancy (LLIFE) declines sharply from the initial period until the second period and a slight increase occurs from the second period to the third period. An increase at the third period is later followed by a slight decline from the third to the fourth period. A slight increase occurs and thereafter an increase occurs in a steady motion. A response of GDP per capita (D(LGDP,2)) to life expectancy (LLIFE) indicates a stable motion of movement laying around positive one even though from period 5 to 8 the motion occurs negatively, government expenditure on education (D(LEDUA,2)) and urban population (D(LURBAN,2)) indicates a similar response to life expectance (LLIFE). Response of government health expenditure (D(LPCHE)to life expectancy (LLIFE) indicates a decline from the initial period to second period, a bit of stability from the second period to the third stage and a slight decline thereafter declining. Total fertility rate's (D(LTFR,2)) response to life expectancy (LLIFE) indicates a decrease from the negative side of the graph followed by an increase immediately when it reaches the positive side of the graph from the initial period to the second period. There is a sharp decline from the second period to the third period a slight increase occurs from the third to the fourth period, thereafter a shock (innovation) drops at a stable motion. The response of undernourishment (LUNOUR) to life expectancy (LLIFE) showcases a quadratic relationship.

5.2Objective 2: To investigate the causality relationship between life expectancy and socioeconomic variables.

Granger Causality test

Table 5,2,1: Granger Causality Test

Direction of Causation	F-statistics	Probability	Remark
D(LGDP,2)→LLIFE	0.02960	1.0000	DNR
LLIFE→D(LGDP,2)	0.12236	0.9981	DNR
D(LEDUA,2)→LLIFE	0.12520	0.9980	DNR
LLIFE→D(LEDUA,2)	0.01789	1.0000	DNR
D(LIWS,2→LLIFE	0.44283	0.8908	DNR
LLIFE→D(LIWS,2)	2.20115	0.0386	REJECT
D(LPCHE→LLIFE	0.69253	0.6967	DNR
LLIFE→D(LPCHE)	1.20681	0.3089	DNR
D(LTFR,2)→LLIFE	4.19298	0.0004	REJECT
LLIFE→D(LTFR,2)	1.82378	0.0884	DNR
LUNOUR→LLIFE	5.34196	3.E-05	REJECT
LLIFE→LUNOUR	3.39710	0.0025	REJECT
D(LURBAN,2→LLIFE	0.25712	0.9772	DNR
LLIFE→D(LURBAN)	0.06223	0.9998	DNR

Source: Author's computation

Granger CWJ (1969) in his representation theorem states that, a variable X is said to granger-cause another variable says Y if past and present value of X help to predict Y. In simple terms this can be explained using two variables, life expectancy and per capita GDP. Life expectancy is said to granger-cause per capita GDP if life expectancy can be better predicted using the histories of both life expectancy and per capita GDP. From the above table the null hypothesis that states that variable X does not granger-cause variable Y and variable Y does not granger-cause variable X is accepted. It's only a few variables that indicate causality. From the table above, it is evident that a bi-directional causal relationship occurs for most variables with a unidirectional flow of relationship occurring to some of the variables. The log of gross domestic product (LGDP) showcases a bidirectional relationship with the log of life expectancy (LLIFE) where granger causality has been indicated not to occur between the two variables, the same applies for the log of government education expenditure (LEDUA) and the log of life expectancy (LLIFE). The log of an access to sustainable drinking water (LIWS) does not granger cause log of life expectancy whereas log of life expectancy (LLIFE) has been indicated to granger cause log of an accessible sustainable drinking water. Life expectancy and access to sustainable water have a unidirectional causal relationship in favor of life expectancy having a causal relationship with the availability of sustainable water in communities. Log of per capita health expenditure (LPCHE) also have a bidirectional causal relationship with log of life expectancy (LLIFE) whereby these variables do not granger cause each other, the same has been evident with log of urban population (LURBAN) and log of life expectancy (LLIFE). Health expenditure per capita and urban population do not granger cause life expectancy and life expectancy does not granger cause these variables. Log of total fertility rate (LTFR) granger causes log of life expectancy (LLIFE) and log of life expectancy (LLIFE) have no causal relationship with log of total fertility rate (LTFR), a unidirectional relationship also is evident on these results in favor of the total fertility rate as the total fertility granger causes life expectancy. Log of undernourishment (LUNOR) and log of life expectancy (LLIFE) granger cause each other, a bidirectional relationship is evident.

Normality test

Table 5,2,2: the VAR Residual Normality Test (Cholesky)

Component	Test criterion	Joint	Probability
8	Skewness	56.84951	0.0000
8	Kurtosis	1711.312	0.0000
8	Jarque-Bera	1768.161	0.0000

Source: Author's computation

The test rejects the hypothesis of the normality of distribution because the p-value is less than 5% there rejecting the null hypothesis. For all the test criterion it is evident that they are significant.

5.3. Objective 3: To examine the differentials between males and females on life expectancy.

Table 5,3: independent t-test for male and females

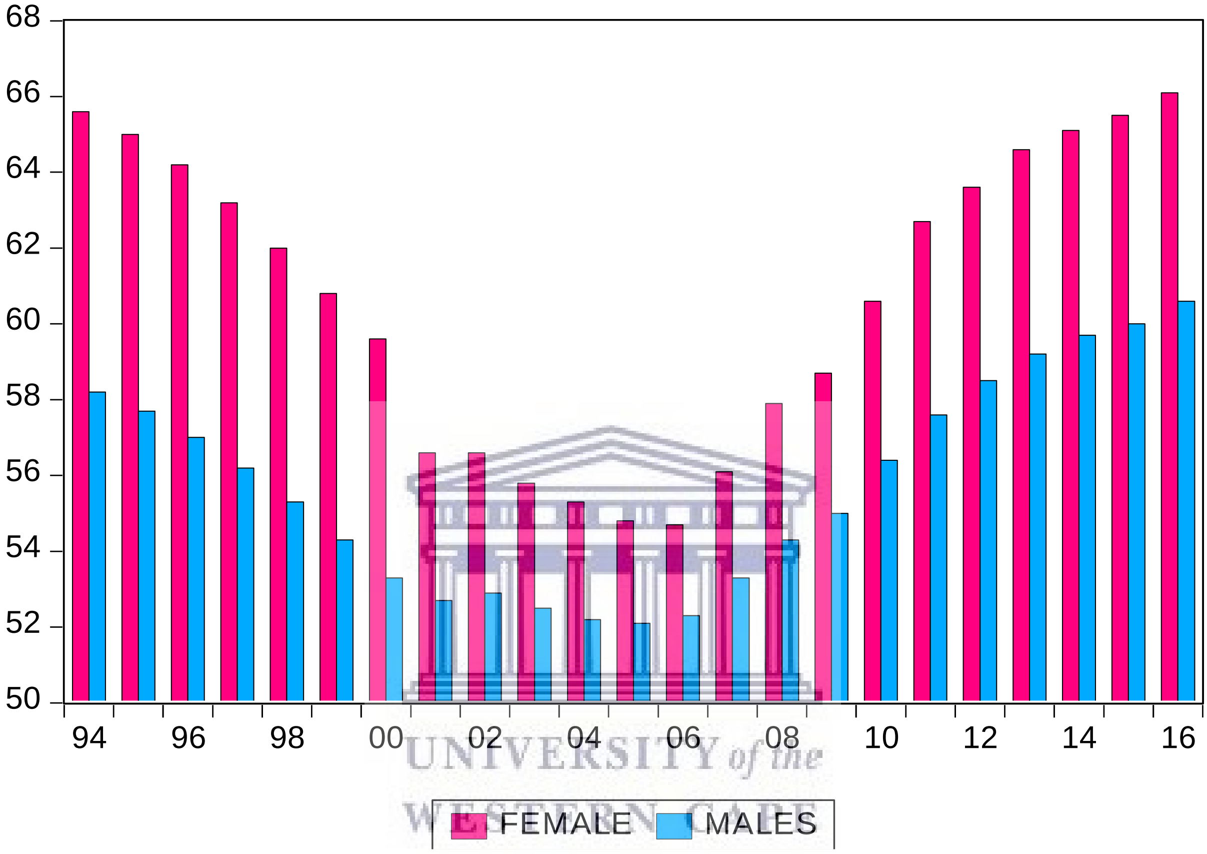
Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Life Expectancy	Males	23	55.71	2.819	.588
	Females	23	60.66	4.009	.836

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Life Expectancy	Equal variances assumed	5.514	.023	-4.841	44	.000	-4.948	1.022	-7.007	-2.888
	Equal variances not assumed			-4.841	39.479	.000	-4.948	1.022	-7.014	-2.882

Source: extracted from SPSS by the author

The group statistics provides us with basic information, the number of years (N) into which this study is conducted which is from 1994 – 2016 (23 years) and the average life expectancy with the average life expectancy for males being 55,71 and females 60,66. On average males are expected to live up to 55,71 years and females are expected to live up to 60,66 years on average. The independent t-test table was used for interpreting the objective. It is evident from the above table that there is a difference between male and female life expectancy. The value in the Sig. (2 tailed) column is less than 0,05 thus indicating a significant difference in the mean scores.

Figure 5,3: South African Male & Female



Source: extracted from EViews by the author

Female life expectancy is considerably higher than male life expectancy. The reasons to this are not entirely certain, hypothetically speaking socio-economic and environmental factors play a major role, hard labor relations, and the kind of lifestyle chosen, and intentional and non-intentional injuries to mention a few factors. South African male and female life expectancy have a slight decline in between the year 2002 and 2010. Female life expectancy dropped from 65, 5 years in 1994 to 59, 6 years in 2000 according to the World Bank data and continued to decline from 56,6 years to 54,6 years in 2006 (Statistics South Africa,2016). The is an increase in female life expectancy in 2007 up until 2016, an increase of 56,1 years to 66,1 years in 2016 in the presence of the HIV/Aids in South Africa. Life expectancy for males is also following the same trend, in 1994 life expectancy was 58,2 years dropping to 53,3 years in 2000 (World Bank, 2011). The is a very slight decline from 2001 to 2006 in male life expectancy as life expectancy was 52,7 years in 2001 and 52,3 years in 2006. An increase occurs from 2007 (53, 3 years) to 2016 (60, 6 years).

5.4 Discussion

5.4.1 Objective 1: To determine the impact of socioeconomic variables and health policy efforts on life expectancy

Numerous tests were done to explain the impact of socioeconomic variables and health policy efforts on life expectancy. For this objective, we had preliminary results, main results and confirmatory results explaining life expectancy. We tested for Var however the VECM was used as the main result because variables co-integrated under Johansen co-integration test. We also used the VAR model to get a different perspective in results even though the variables under the cointegration test indicated co-integration. The Johansen co-integration was used to test co-integration, under the trace test statistics six equation co-integrated with only two equations that did not co-integrate at 5% level of significance. The co-integrating variables serves as confirmation to rejection of the null hypothesis that stated that socioeconomic determinants and health policy efforts have no impact on life expectancy in post-apartheid South Africa and vice versa. When testing co-integration using the maximum eigenvalue test only one equation indicated to be co-integrating at the 5% level of significance (r = 0), seven other equation where not co-integrating.

The speed of adjustment that test the long run equilibrium was negative and statistically significant, refraining its economic interpretation. The co-efficient negative sign which was -0,006195 indicated that the socioeconomic variables have a significant relationship as the departure in one direction indicates that the correlation will have to be pulled back in the other direction to maintain equilibrium. The previous periods deviation from long run equilibrium was corrected at a speed adjustment of 0,6 percent in the current period. Cremieux *et al*., (1999) shares a similar opinion on socioeconomic variables having an impact on life expectancy but emphasized that income per capita, public health spending, safe drinking water, calorie intake and literacy were the main determinants of life expectancy. Sede and Ohemeng (2015) also supported this by stating that socioeconomic determinants accounted for 90% gains in life expectancy given a lag of up to three years. Table5,1,4,1 made it evident that government health expenditure, the total fertility rate, undernourishment and urban population have no impact on life expectancy as a percentage change in these variables is associated with a percentage decrease in life expectancy on average in the short run.

These mentioned findings from table 5,1,4,1 contradict with the results obtained from the previous studies; Bidzha, Greyling and Mahabir (2017) argued that investing in health is significant in South Africa. Likewise, Rogers and Wofford (1989) discovered that urbanization and average calorie per person had a significant role in determining life expectancy however from their statement access to drinking water confirm was justified to have an impact to life expectancy. Kalediene and Petrauskiene (2000) argued that for both developed and developing countries, urbanization was one of the important determiners of life expectancy because in urban areas accesses to better services have a significant impact in an increased life expectancy. Statistics South Africa (2018c) indicated that South Africa is expected to experience a continued increase in old age dependency as the TFR has declined over time with an increase in life expectancy.

Government education expenditure, GDP per capita and an access to sustainable drinking water are classified as variables that may not translate to higher life expectancy in the short run but significant. Lin *et al*., (2012) supports the results by emphasizing that expenditure on education have a positive significant effect on life expectancy and improvements in life expectancy can be accredited more directly to enhancements in the national economy than to the other factors. Similarly, Ali and Ahmad (2014) argued that an increase in per capita income and changing the expenditure structure in developing countries could have a positive impact on life expectancy. Mondal and Shitan (2014) also stated that recent studies examining the possible determiners of life expectancy discovered that the most important determinant of life expectancy was income. Macfarlane *et al*., (2000) confirmed with the above results by identifying that safe drinking water is an important determiner of life expectancy in developing nations. In the study conducted by Sauvaget *et al*., (2011) about 20 percent of death found were for people who were illiterate while more than 12 percent of the study population received a college education, hence government education expenditure is classified as a variable that may not lead to higher life expectancy though the variable is significant. Ali and Ahmad's (2014) empirics concluded that education have a dual effect on life expectancy as the more educated the population is, an improvement in health conditions as well as the production of food become prominent. Labadarios *et al*., (2011) mentioned that according to Davids (2006) South Africa still distinguish themselves as a country that lacks enough income to meet their household income after 10 years of democracy hence this variable has an impact to South African life expectancy.

The UNICEF (2017) states that the total government expenditure on health accounts for an average of 13,5% share on health programs which appear to be stable even though a percentage change in health expenditure was indicated to contribute in a percentage decrease in life expectancy. The medium-term expenditure framework (MTEF) showed no signs of growth on provincial health programs hence there is a decline in life expectancy according to the results. The government was therefore encouraged to priorities services that will benefit children and minimize the rate into which infant mortality occurs as this is a health-related issue. This therefore takes us to the National Development Plan 2030 that plans to raise life expectancy to at least 70 years, ensuring that the generation of the under 20's is largely free of HIV and significantly reduce the burden of diseases.

UNICEF (2016) states that 17% of the total government expenditure on education remained as a budget for school children even though the education expenditure indicated lack of growth over the medium term. The government is therefore encouraged to priorities spending on programs such as early childhood education, the national school nutrition program that will assist in elevating undernourishment, the no-fee school allocation, support for public special school education and infrastructure spending in the most disadvantaged areas. A positive percentage change in education expenditure would increase South African life expectancy. The government must invest on education expenditure for a positive increase in life expectancy to occur. The government is also encouraged to convince the national and provincial decision makers not to expurgate the education expenditure as there are some areas of improvement. An improvement in disease prevention and treatment, nutritional intake, level of education, an improved living and working conditions result to a better quality of life worldwide (Sauvaget *et al*., 2011).

An improvement in education expenditure, a growth in South African GDP per capita, and the availability of a sustainable drinking water to all people have a positive impact on life expectancy. In a study that was conducted by Sauvaget *et al*., (2011) it was evident that about 20 percent of mortality that occurred were people that were illiterate, this justifies the significance of education and government education expenditure in entire life time.

5.4.2. Objective 2: To investigate the causality relationship between life expectancy and socioeconomic variables.

When investigating the causality relationship between variables and life expectancy, the granger causality test was implemented with the normality test. Granger causality was the main result and the normality test was used as a confirmatory test. It was evident from the results that some variables do granger cause life expectancy whereas some of the variables do not granger cause life expectancy and vice versa. The relationship between the socioeconomic variables and life expectancy was unidirectional and bidirectional for other variables. It became evident that log of GDP per capita (LGDP) does not granger cause log of life expectancy (LLIFE) and log of life expectancy (LLIFE) does not granger cause the log of GDP per capita) LGDP, this therefore indicates that these two variables operate independently from each other in South Africa and the same applied for variables that showcased no granger causality between them and life expectancy. These findings from the granger causality test contradict with what Bidzha, Greyling and Mahabir (2017) discovered as in their study it was evident that GDP per capita is statistically significant at 10% level of significance and this meant that a 1% increase in GDP per capita will on average, result in improvement in life expectancy by 0,2% holding other influences constant.

The scenario differed with the availability to sustained water and life expectancy, it became evident that life expectancy granger causes the accessibility to sustained water thought this relationship was unidirectional in favor of life expectancy. SAHRC (2014) indicated that "the lack of hygiene has a huge impact on school attendance, especially for girls," and "diarrhea is also a major problem that leads to deaths and high absenteeism". Diarrhea is an effect of drinking and the use of not purified water. The total fertility rate has an impact on either an increase or decrease in life expectancy. The Census (2011) indicates that the total fertility rate continued to decline to a 2,67 fertility rates in South Africa. The pattern of a female's fertility behavior becomes evident through the information of the number of children a woman indicates. This information is important as it describes family formations and provides a clear indication of factors influencing the fertility transition in South Africa. The decline in total fertility rate from the Census (2011) data between 1996 and 2011 was indicated by a decline in PRR and an indication of the two-child preference among women aged 45-49. This led to an analysis which made it evident that the PRR by socioeconomic demographic characters indicated the partiality of progressing to higher birth orders for certain subgroups of women thus an increase in life expectancy can be expected when such changes in ferity are prevalent. Undernourishment and life expectancy have a bidirectional relationship, this therefore indicates that both these variables granger cause each other. To support this output Bicuinate (2014) indicated that there is a sequential significant relationship between food prices and how people die. If the food prices increase, this therefore becomes a survival of the fittest situation as the poor of the poor become more affected by this thus death becomes evident.

South Africa has declining levels of fertility justifying why the ASFRs pattern and trends needs to be consistent. The levels of ASFR and the errors noticed in the rates acts as independent factor when estimating fertility. There was a decline in the total fertility rate in 2001 of 2,84 children per woman to 2,67 children per woman 2011. The level of decline between 1996 and 2011 is also striking, this type of pattern in fertility rate explains the countries level of development. Moultrie *et al*., (2008) also confirms the mentioned justification in a decline in fertility rate and states that the decline has stalled since 1990. This then justifies the output of the total fertility rate having an impact on either an increase or decrease in life expectancy.

UNICEF (2017) argues that South Africa's health expenditure rate compared to other African countries is favorable though this variable from the study findings indicated no granger causal direction with life expectancy. South Africa is indicated as one of the highest investors in health, spending more than some of the neighboring countries but less than Lesotho and Malawi. In improving life expectancy, the NDP 2030 came with strategies that will improve life expectancy through guidelines that will develop the country. The NDP 2030 plans on improving schooling sectors through the collaboration of their strategic plans and the DBE's action plan to 2019. It has been evident from the results that government education expenditure does not granger cause life expectancy and life expectancy have no causal relationship with government education expenditure.

5.4.3Objective 3: To examine the differentials between males and females on life expectancy.

In testing this objective an independent t- test was conducted. The results from this study presented the differences between males and females on life expectancy. From the results, females have a higher life expectancy compared to that of males. These results agree with the hypothesis that stated life expectancy for females tend to be higher than that of males. This makes sense biologically as 105 males are born for every 100 females (WHO, 2018). The advantage that women have which is biological is taken as an assurance of males dying younger than females from the very onset of life. According to Tan (2016) male mortality rate is 25 to 30 percent greater than is female mortality. Furthermore, the hormonal effect and their role in reproduction have been linked to female greater longevity; this might be since they produce estrogen which facilitates as the eliminator of bad cholesterol and thus it offers some protection against heart diseases, liver failure and because females are highly linked to violence and risk taking. Since the female body can accommodate the needs of pregnancy and breastfeeding this creates a greater ability to cope with overreacting and eliminating excess food.

From the above table 5,2,3 and figure 5,2,1, it is evident that females have a highest life expectancy compared to males. This confirms Keita (2013) argument on female life expectancy being higher than male life expectancy. On average females are expected to live up to 60,6 years and males have a life expectancy of up to 55,71 years. This has been a continuous trend as from 1994 – 2016. In between these years there have been a major decline in female life expectancy, from 1994 female life expectancy was 65,6 years with a slight decrease from 1995 of 0.6 years to 60,8 years in 1999. After 1999 the years in which females could live rotated around 55,5 years. In 2000 female life expectancy was 59,6 a huge drop from 65,6 years in 1994, female life expectancy dropped from 59,6 years in 2000 to 54,7 years 2006. After 2006 there was an increase from 54,7 years in 2006 to 56,1 years in 2007. Life expectancy continued to increase slightly from 56,1 years in 2007 to 66,1 years for females in 2016. Even though females out live males but the trend in life expectancy for males is a bit stable compared to that of females. Females moved from a life expectancy of 65,6 to 54,7 and from 54,7 years to 66,1 years. Males life expectancy was 58,2 years in 1994 dropped to 52,3 years in 2006 and from52,3 years to 60,6 years in 2016. Life expectancy for males was stable by 52,7 years in 2001 to 52,3 years in 2006; a stability of 6 years unlike that of females that last for an average of 3 years. It is evident from the results if there is a significant difference in male and female life expectancy.

Excluding the behavioral and environmental factors indicated to affect the life expectancy for males more than that of females there could be a fundamental difference in the lifestyle men and women choose which might be the leading reason as why males have a lower life expectancy than females. This can include the contamination of alcohol, smoking, racing of cars hypothetically. The different lifestyle includes the work environments for females and males, females tend to work in areas that are less harmful to their health and males mostly work in areas that are mostly toxic to their health. In addition, the way not which women relate to their bodies is different to how males relate in relation to their health and lives. Females are more attentive to how their bodies changes and often visit doctors when there are unfamiliar changes.

The issue with gender differences is an issue that begins from an intermediate family whereby there are gendered roles to be played in a household, certain house chores that only males can practice and vice versa. Growing up with such mentality hinders an individual's wellbeing. The null hypothesis for this objective state that female's life expectancy tends to be higher than that of males. We accept the null hypothesis as it evident from the results that females have a higher longevity than males. Hypothetically, male life expectancy is placed at stake by several debatable factors associated with the socio-environment. On average males consume more alcohol and other contagious drugs than females and more likely to die from injuries, these injuries can either be intentional and some unintentional. Males are associated with being high risk takers than females; they work in unsafe environments where in most cases they end up placing their lives at stake. Drevenstedt *et al.*, (2008) states that the physical appearance that males possess which includes being stronger, taller and less overweight does not boost their life expectancy regardless. On the other hand, the Longevity Science Advisory Panel (2012) stand firm on their grounds stating that men smoke more than women, a reason that explains the gender variations between males and female life expectancy.

The above results show variation in life expectancy using gender. These results showcase a clear view of when life expectancy for females and males started declining and when the increment occurred. Males have a lower life expectancy than females, this implies that if both males and females would invest firstly on their education and try as much as possible not to be illiterate their life expectancy would increase. The first procedure to this would be that of government spending more on education. As indicated in the previous chapters that people die from both diseases and non-diseases which include accidents this would imply that by firstly being literate that would mean an individual can have at least read and understand how one can better his/her life expectancy. Government expenditure on health would mean low levels of death as government would be spending on health facilities, number of physicians, number of beds at hospitals, more nontoxic medication with less after effects and new health innovations that would improve the health. With such health improvements, that would mean a woman will be able to give birth to the exact number of children liable to her given she were to pass through the childbearing years. If South African GDP per capita would increase that would mean developments in urban areas would be suitable for its inhabitants with people living in the outskirts benefiting through decentralization as there would not be a need for people to crowd in urban areas due to availability of basic resources in their areas.

Chapter six: conclusion and Recommendations

6.1 Summary and Conclusion

This study has focused on the effect of socio-economic factors on the fluctuation of life expectancy in South Africa. The selected variables such as GDP per capita (PPP), education expenditure, government drinking expenditure, access to sustainable water, total fertility rate, undernourishment and several people living in urban areas were used to explain how they influence the trends of life expectancy in post –apartheid south Africa. The outcome of these variables showed that not all of them have significance on life expectancy. During an investigation on how the socioeconomic variables and health policy efforts impact life expectancy it became evident that government expenditure, per capita GDP and an access to sustainable water have an impact on life expectancy. A percentage change in government health expenditure, total fertility rate, undernourishment and urban population was indicated to be associated with a percentage decrease in life expectancy. This study enabled us with information on how each variable influence the growth and decline in life expectancy. It is confirmed from the above results and literature that South Africa still has a mile to go for its economy to grow in a manner into which it can sustain its inhabitants.

The ADF test was conducted to confirm if the time series is stationary or not. The ADF output indicated stationary variables. Johansen co-integration test was used to test if the equation were co-integrating or not co-integrating at the 5% level of significance. At least six equations under the trace statistics showed co-integration and the maxim eigenvalue test indicated only one co-integrating equation. We therefore used the VECM for co-integrated equations and VAR for equations that do not co-integrate. In explaining the content on statistics, the VECM and VAR model were used. In justifying the VECM a numerous test was conducted, these tests include the system of equation, the Wald test, serial correlation LM test, and the stability test. For the VAR model, an inverse root of AR polynomial characteristics was used to confirm and justify the VAR model. In explaining the VECM, the system of equation and the Wald test was used as these tests contain information on dependent variables that have a long and short run relationship with their independent variables.

The VECM was tested to restrict the long run behavior of endogenous variables while allowing for a short run dynamic. From the long run behavior, it was evident that the most crucial parameter in explaining the VECM is the error correction which explained that the last period deviation from the long run equilibrium influences the short run dynamics of the dependent variable. The previous periods deviation from the long run equilibrium was corrected in the current period and adjusted to 0,06%. The error correction term does this by measuring the speed of adjustment of economic growth to its equilibrium level.

The system of equation indicated a long run relationship between life expectancy as a dependent variable and its independent variables, the socioeconomic variables. The coefficient which is indicated by c (1) is negatively significant, justifying the long run relationship between the dependent variable and independent variables. The Wald test indicated a short run relationship between variables. The null hypothesis states that the socioeconomic variables and health policy do not have any significance on life expectancy. From the results in table 5,1,4,3, we therefore concluded that we reject the null hypothesis that states that the socioeconomic variables and health policy do not any significance on life expectancy. The null hypothesis is rejected at a 67% level of significance. This objective scrutinizes the impact of socioeconomic variables and health policy efforts on life expectancy. When testing for VAR it was evident that no root lies outside the unit circle, the VAR satisfied the stability condition.

The speed of adjustment suggested that the data was statistically significant. The speed of adjustment was statistically significant indicating the explanatory variables under study granger cause life expectancy. It became evident from the granger causality test that life expectancy granger causes some of the variables and does not granger cause some variables. The null hypothesis was accepted for most of the variables, it was only rejected when showcasing the relationship between life expectancy and access to sustainable water. From table 5,2,1 it was clear that life expectancy granger causes the accessibility of sustained water and this was a unidirectional relationship as the output favored life expectancy. Total fertility rate also granger causes life expectancy at a unidirectional relationship with a bidirectional relationship between undernourishment and life expectancy. When explaining the difference between life expectancy for males and females it was evident that females have the highest life expectancy compared males. This output was further confirmed by writers mentioned in the study.

In conclusion, there is a difference between male and female life expectancy and there is no guarantee that improvements in government health expenditure, total fertility rate, undernourishment and people living in urban areas may put forth positive unrelenting effects on the life expectancy of South African population though for government education expenditure, per capita GDP and access to sustainable drinking water became evident on having an impact. It also became evident from the results that total fertility rate, undernourishment, and access to sustainable water have a causal relationship with life expectancy. This agrees with the conceptual framework that stipulated that there should be a decline in total fertility rate, the number of people prevailed to undernourishment and an increase of sustained water as these variables have a causal relationship with life expectancy. The socioeconomic variables indicated a long run relationship between them and life expectancy and it has been evident that for life expectancy and the socioeconomic variables to reach equilibrium, a correlation for variable x would have to pulled back in the other direction to maintain equilibrium for variable y that departed in one direction. There was evidence from the results that there also a short run relationship between the socioeconomic variables and life expectancy occurs. Increasing life expectancy would suggest an increase in industrialization, intense agricultural production, and more jobs.

6.2 Policy Recommendations

Based on the observed results, government should invest more money on providing purified drinking water as this variable has an impact and a causal relationship with life expectancy. Purified water needs to be made accessible not only in urban areas but also in the outskirts and rural areas. It has been evident that drinking contaminated water influences the decreasing life expectancy as mortality becomes evident due to illnesses caused by drinking and household usage of the contaminated water. People need to be educated on what it means to be fertile and health facilities need to invest more in programs where it will educate people on fertility. The government can do this by investing mostly on education and health as these two variables interlink with all the other variables. When people are literate and highly educated, their understanding of the lifestyle that would impact their live negatively improves hence an increase in life expectancy would be evident. Undernourishment would not be a problem for most people as they would be informed about means of food production which would include agriculture. It has been evident that undernourishment influences life expectancy, the government needs to implement food security strategies that will benefit communities. The government needs to align more with the South African long term and short terms goals which include but not limited to the MDG's, SDG's, and NDP 2030. For policy implications, governments need to raise an awareness of education among South African population more especially to the youth. By being educated people will be able to take care of themselves and teach the communities they reside on how they can live a healthy lifestyle. In South Africa it has been noted in the present study that even though these variables have significance on changing life expectancy not all of them have a higher significance. Government needs to invest in the economy as this will increase the economic growth meaning more income distribution, an increase in employment rate, and an increase in life expectancy.

6.3 Scientific Contribution of the Study

This research study will inform government and the stakeholders about the significance of life expectancy. Researchers and policy makers will have an idea of how far we as South Africans have gone in improving life expectancy. Government will be able to invest more money where needed and will be able to invest more on health facilities more especially on public hospitals and primary health care services. The study will enable researchers to have a base of a source of referral as in South Africa we have a minimum research done on life expectancy. The economy is declining; this study can serve as a link for filling in the gaps in the country as it showcases the importance of investing in each variable mentioned under study.

1. The government needs to invest more on the socioeconomic variables as these variables have a long run relationship with life expectancy.
2. This result showcases the importance of investing more on the availability of sustainable water, fertility rate and nutrition.
3. Education has been indicated as a variable that seemed to influence all the other variables, the study therefore will enable policy makers to strategize in a manner that will be suitable for the country.

6.4 Reflection and Implications of Study Findings for Current Theory

The epidemiological transition is the theory used to substantiate life expectancy in South Africa. This theory explains the changing patterns of mortality and was the best theory for the study as it considers changes in health care centers and the role, they play in improving life expectancy. Epidemiologic transition explains the study better than the as it studies life expectancy by focusing on what may be causing a decrease or increase in life expectancy, the impact each variable might have on life expectancy and health policies and thus later providing explanation on to how males and females life expectancy differ by studying both genders according to ailments that may hinder both genders differently. This theory also justifies an increase or decrease in life expectancy by including the socioeconomic changes that occur thus improving life expectancy. This theory explains life expectancy well as it understands that people die young or older due to a numerous cause of death. Epidemiological transition suggests that as epidemiological transition moves forward through the four stages life expectancy also increases over time. The study findings showcased a statistically significant relationship as a value for the speed of adjustment was negative. Per capita income, government education expenditure and access to sustainable water are variables that were indicated to mostly have an impact on life expectancy. Total fertility rate, undernourishment and an access to sustainable water have a causal relationship with life expectancy. epidemiologic transition is categorized into four theories and from the four theories it is evident that South Africa is still at the third stage and can approach the fourth stage sooner if it would comply with the study finding.

6.5 Reflections on Methodological Issues

A lack of reliable data was one of the limitations encountered under this research but had to use the World Bank data as it had no missing data for certain years. The period into which South African life expectancy is examined which is from 1994-2016 was problem as the data had to be converted to quarterly on E-Views due to the unavailability of quarterly data collected in South Africa for all the variables. To confirm the results several tests had to be done which include the preliminary results, the confirmatory to the main results. These results were done to check whether they complement each other. The evidence provided by the vector error correction model has a great impact on creation of health policies as the results indicate which areas South Africa needs to prioritize for an increase to life expectancy to occur. The vector autoregression suggested that there was no root that lied outside the unit circle thus satisfying the stability condition. The hypothesis that stated that there is no causal relationship between the socioeconomic variables and life expectancy was rejected because the granger causality test made it evident that between the total fertility rate, undernourishment, access to sustainable drinking water and life expectancy a granger causal relationship occurs. The causal direction for access to sustainable water was in favor of life expectancy as life expectancy granger causes an access to sustainable water. Total fertility rate and undernourishment granger caused life expectancy with a bidirectional relationship between undernourishment and life expectancy. When testing for independent test and the use of the bar graph reflected how female and male life expectancy differ, with females indicated to have a higher life expectancy than males.

6.6 Limitations of the study

The study is limited in the sense that there is a minimum research done on determiners of a decline and increase in South African life expectancy. In addition, finding relevant information has been a challenge for this research. Life expectancy has mostly been studied as an indicator of development in South Africa not entirely with the socioeconomic variables as determiners of life expectancy. The unavailability of data in South Africa was one of the major limitations as variables that would have justified life expectancy were unavailable or only a few years that were captured. Explaining the VECM and VAR model was a challenge, but the speed of adjustment had to be used to explain the long run relationship between the socioeconomic variables and life expectancy. Nevertheless, this study is not suffering from omission bias.

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APPENDIX
Augmented Dickey Fuller

Null Hypothesis: LLIFE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.036110	0.0000
Test critical values:	1% level	-4.064453	
	5% level	-3.461094	
	10% level	-3.156776	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LLIFE)
Method: Least Squares
Date: 11/15/18 Time: 22:15
Sample (adjusted): 1994Q4 2016Q4
Included observations: 89 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LLIFE(-1)	-0.007110	0.000885	-8.036110	0.0000
D(LLIFE(-1))	0.717293	0.102785	6.978597	0.0000
D(LLIFE(-2))	0.336944	0.107999	3.119873	0.0025
C	0.029219	0.003609	8.095797	0.0000
@TREND(1994Q1)	-1.05E-05	2.79E-06	-3.779339	0.0003

R-squared	0.992276	Mean dependent var	7.33E-06
Adjusted R-squared	0.991908	S.D. dependent var	0.004098
S.E. of regression	0.000369	Akaike info criterion	-12.91894
Sum squared resid	1.14E-05	Schwarz criterion	-12.77913
Log likelihood	579.8927	Hannan-Quinn criter.	-12.86258
F-statistic	2697.823	Durbin-Watson stat	2.074018
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LLIFE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.890466	0.9517
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LLIFE,2)
Method: Least Squares
Date: 11/15/18 Time: 22:16
Sample (adjusted): 1996Q3 2016Q4

Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LLIFE(-1))	-0.020261	0.022754	-0.890466	0.3762
D(LLIFE(-1),2)	-0.136713	0.108563	-1.259296	0.2120
D(LLIFE(-2),2)	0.086699	0.111062	0.780640	0.4376
D(LLIFE(-3),2)	0.145094	0.113970	1.273098	0.2071
D(LLIFE(-4),2)	0.045799	0.126831	0.361102	0.7191
D(LLIFE(-5),2)	0.090766	0.115310	0.787151	0.4338
D(LLIFE(-6),2)	-0.008500	0.137077	-0.062007	0.9507
D(LLIFE(-7),2)	-0.107367	0.202041	-0.531409	0.5968
D(LLIFE(-8),2)	1.335152	0.294676	4.530923	0.0000
C	0.000200	0.000215	0.930280	0.3554
@TREND(1994Q1)	-5.58E-06	4.35E-06	-1.283371	0.2035

R-squared	0.547321	Mean dependent var	7.48E-06
Adjusted R-squared	0.483563	S.D. dependent var	0.000519
S.E. of regression	0.000373	Akaike info criterion	-12.82477
Sum squared resid	9.89E-06	Schwarz criterion	-12.50192
Log likelihood	536.8156	Hannan-Quinn criter.	-12.69515
F-statistic	8.584388	Durbin-Watson stat	2.087524
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LLIFE,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.808760	1.0000
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LLIFE,3)
Method: Least Squares
Date: 11/15/18 Time: 22:17
Sample (adjusted): 1996Q3 2016Q4
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LLIFE(-1),2)	0.376392	0.208094	1.808760	0.0747
D(LLIFE(-1),3)	-1.533435	0.244424	-6.273674	0.0000
D(LLIFE(-2),3)	-1.467806	0.290169	-5.058450	0.0000
D(LLIFE(-3),3)	-1.348201	0.330386	-4.080688	0.0001
D(LLIFE(-4),3)	-1.313910	0.346816	-3.788487	0.0003
D(LLIFE(-5),3)	-1.232851	0.326071	-3.780922	0.0003
D(LLIFE(-6),3)	-1.236300	0.289644	-4.268349	0.0001
D(LLIFE(-7),3)	-1.307778	0.292646	-4.468807	0.0000
C	0.000363	0.000112	3.252220	0.0017
@TREND(1994Q1)	-8.89E-06	2.26E-06	-3.927150	0.0002

R-squared	0.693430	Mean dependent var	-1.02E-05
Adjusted R-squared	0.655109	S.D. dependent var	0.000635

S.E. of regression	0.000373	Akaike info criterion	-12.83805
Sum squared resid	1.00E-05	Schwarz criterion	-12.54455
Log likelihood	536.3602	Hannan-Quinn criter.	-12.72022
F-statistic	18.09516	Durbin-Watson stat	2.062592
Prob(F-statistic)	0.000000		

Null Hypothesis: LEDUA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.752644	0.7189
Test critical values:	1% level	-4.068290	
	5% level	-3.462912	
	10% level	-3.157836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEDUA)
Method: Least Squares
Date: 11/15/18 Time: 22:17
Sample (adjusted): 1995Q3 2016Q4
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEDUA(-1)	-0.034657	0.019774	-1.752644	0.0836
D(LEDUA(-1))	0.709401	0.096838	7.325657	0.0000
D(LEDUA(-2))	0.136632	0.093579	1.460061	0.1483
D(LEDUA(-3))	0.058364	0.094846	0.615354	0.5401
D(LEDUA(-4))	-0.700452	0.094458	-7.415455	0.0000
D(LEDUA(-5))	0.520843	0.096419	5.401867	0.0000
C	0.137112	0.076865	1.783806	0.0783
@TREND(1994Q1)	0.000180	0.000113	1.588191	0.1163

R-squared	0.624132	Mean dependent var	0.004806
Adjusted R-squared	0.590400	S.D. dependent var	0.008439
S.E. of regression	0.005401	Akaike info criterion	-7.516041
Sum squared resid	0.002275	Schwarz criterion	-7.287729
Log likelihood	331.1898	Hannan-Quinn criter.	-7.424156
F-statistic	18.50277	Durbin-Watson stat	2.083852
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEDUA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.164019	0.0987
Test critical values:	1% level	-4.068290	
	5% level	-3.462912	
	10% level	-3.157836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEDUA,2)
Method: Least Squares
Date: 11/15/18 Time: 22:18
Sample (adjusted): 1995Q3 2016Q4
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEDUA(-1))	-0.378227	0.119540	-3.164019	0.0022
D(LEDUA(-1),2)	0.067562	0.100203	0.674255	0.5021
D(LEDUA(-2),2)	0.193246	0.098622	1.959461	0.0536
D(LEDUA(-3),2)	0.234158	0.098477	2.377782	0.0198
D(LEDUA(-4),2)	-0.491068	0.096147	-5.107469	0.0000
C	0.002424	0.001597	1.517163	0.1332
@TREND(1994Q1)	-1.40E-05	2.46E-05	-0.569151	0.5709

R-squared	0.579078	Mean dependent var	-7.33E-05
Adjusted R-squared	0.547109	S.D. dependent var	0.008130
S.E. of regression	0.005471	Akaike info criterion	-7.500671
Sum squared resid	0.002365	Schwarz criterion	-7.300898
Log likelihood	329.5288	Hannan-Quinn criter.	-7.420272
F-statistic	18.11387	Durbin-Watson stat	2.029341
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEDUA,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.153015	0.0000
Test critical values:	1% level	-4.068290	
	5% level	-3.462912	
	10% level	-3.157836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEDUA,3)
Method: Least Squares
Date: 11/15/18 Time: 22:18
Sample (adjusted): 1995Q3 2016Q4
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEDUA(-1),2)	-1.737398	0.189817	-9.153015	0.0000
D(LEDUA(-1),3)	0.608545	0.169023	3.600368	0.0005
D(LEDUA(-2),3)	0.617276	0.133261	4.632072	0.0000
D(LEDUA(-3),3)	0.667072	0.082720	8.064179	0.0000
C	-0.000524	0.001369	-0.383062	0.7027
@TREND(1994Q1)	6.31E-06	2.51E-05	0.251236	0.8023

R-squared	0.815970	Mean dependent var	3.28E-05
Adjusted R-squared	0.804468	S.D. dependent var	0.013052
S.E. of regression	0.005771	Akaike info criterion	-7.404614

Sum squared resid	0.002665	Schwarz criterion	-7.233381
Log likelihood	324.3984	Hannan-Quinn criter.	-7.335701
F-statistic	70.94223	Durbin-Watson stat	2.173603
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.950522	0.9449
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP)
Method: Least Squares
Date: 11/15/18 Time: 22:19
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.010287	0.010823	-0.950522	0.3445
D(LGDP(-1))	0.800743	0.069803	11.47139	0.0000
C	0.092352	0.094384	0.978466	0.3306
@TREND(1994Q1)	7.54E-05	0.000103	0.731709	0.4663

R-squared	0.637541	Mean dependent var	0.007934
Adjusted R-squared	0.624897	S.D. dependent var	0.006598
S.E. of regression	0.004041	Akaike info criterion	-8.141346
Sum squared resid	0.001404	Schwarz criterion	-8.030243
Log likelihood	370.3605	Hannan-Quinn criter.	-8.096542
F-statistic	50.42273	Durbin-Watson stat	2.289299
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.221204	0.0869
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP,2)
Method: Least Squares

Date: 11/15/18 Time: 22:19
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-0.216763	0.067293	-3.221204	0.0018
C	0.002644	0.001124	2.351713	0.0209
@TREND(1994Q1)	-2.13E-05	1.68E-05	-1.266065	0.2089

R-squared	0.109653	Mean dependent var	-8.19E-05
Adjusted R-squared	0.089185	S.D. dependent var	0.004232
S.E. of regression	0.004039	Akaike info criterion	-8.153117
Sum squared resid	0.001419	Schwarz criterion	-8.069790
Log likelihood	369.8903	Hannan-Quinn criter.	-8.119514
F-statistic	5.357339	Durbin-Watson stat	2.244929
Prob(F-statistic)	0.006395		

Null Hypothesis: D(LGDP,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.97827	0.0000
Test critical values:	1% level	-4.064453	
	5% level	-3.461094	
	10% level	-3.156776	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP,3)
Method: Least Squares
Date: 11/15/18 Time: 22:19
Sample (adjusted): 1994Q4 2016Q4
Included observations: 89 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1),2)	-1.250418	0.104391	-11.97827	0.0000
C	0.000432	0.000920	0.469733	0.6397
@TREND(1994Q1)	-1.15E-05	1.72E-05	-0.671756	0.5035

R-squared	0.625238	Mean dependent var	-1.63E-05
Adjusted R-squared	0.616523	S.D. dependent var	0.006718
S.E. of regression	0.004160	Akaike info criterion	-8.093422
Sum squared resid	0.001488	Schwarz criterion	-8.009536
Log likelihood	363.1573	Hannan-Quinn criter.	-8.059610
F-statistic	71.73961	Durbin-Watson stat	2.008832
Prob(F-statistic)	0.000000		

Null Hypothesis: LURBAN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-1.740218	0.7243
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LURBAN)
Method: Least Squares
Date: 11/15/18 Time: 22:22
Sample (adjusted): 1996Q3 2016Q4
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LURBAN(-1)	-0.043075	0.024753	-1.740218	0.0862
D(LURBAN(-1))	0.805825	0.092759	8.687291	0.0000
D(LURBAN(-2))	0.080521	0.071092	1.132622	0.2612
D(LURBAN(-3))	0.041644	0.070497	0.590717	0.5566
D(LURBAN(-4))	-0.781789	0.070486	-11.09140	0.0000
D(LURBAN(-5))	0.645531	0.094570	6.825972	0.0000
D(LURBAN(-6))	0.036107	0.068853	0.524409	0.6017
D(LURBAN(-7))	0.016768	0.068735	0.243956	0.8080
D(LURBAN(-8))	-0.578395	0.068490	-8.444953	0.0000
D(LURBAN(-9))	0.468699	0.073567	6.371083	0.0000
C	0.172939	0.098753	1.751222	0.0843
@TREND(1994Q1)	8.49E-05	5.04E-05	1.684476	0.0965

R-squared	0.801290	Mean dependent var	0.002047
Adjusted R-squared	0.770064	S.D. dependent var	0.001165
S.E. of regression	0.000559	Akaike info criterion	-12.00733
Sum squared resid	2.19E-05	Schwarz criterion	-11.65513
Log likelihood	504.3006	Hannan-Quinn criter.	-11.86593
F-statistic	25.66115	Durbin-Watson stat	2.227862
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LURBAN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.848234	0.1849
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LURBAN,2)
Method: Least Squares
Date: 11/15/18 Time: 22:23
Sample (adjusted): 1996Q3 2016Q4
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LURBAN(-1))	-0.477976	0.167815	-2.848234	0.0057
D(LURBAN(-1),2)	0.253677	0.122618	2.068848	0.0422
D(LURBAN(-2),2)	0.306244	0.119622	2.560086	0.0126
D(LURBAN(-3),2)	0.318905	0.119707	2.664046	0.0095
D(LURBAN(-4),2)	-0.493696	0.119282	-4.138888	0.0001
D(LURBAN(-5),2)	0.125981	0.077908	1.617057	0.1103
D(LURBAN(-6),2)	0.148951	0.076657	1.943073	0.0560
D(LURBAN(-7),2)	0.151163	0.076291	1.981392	0.0514
D(LURBAN(-8),2)	-0.445996	0.073427	-6.073962	0.0000
C	0.001088	0.000402	2.707397	0.0085
@TREND(1994Q1)	-2.68E-06	2.78E-06	-0.962529	0.3391

R-squared	0.784262	Mean dependent var	9.46E-06
Adjusted R-squared	0.753876	S.D. dependent var	0.001142
S.E. of regression	0.000567	Akaike info criterion	-11.98937
Sum squared resid	2.28E-05	Schwarz criterion	-11.66652
Log likelihood	502.5642	Hannan-Quinn criter.	-11.85975
F-statistic	25.81026	Durbin-Watson stat	2.159062
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LURBAN,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.993636	0.0000
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LURBAN,3)
Method: Least Squares
Date: 11/15/18 Time: 22:24
Sample (adjusted): 1996Q3 2016Q4
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LURBAN(-1),2)	-2.383253	0.264993	-8.993636	0.0000
D(LURBAN(-1),3)	1.342838	0.234125	5.735567	0.0000
D(LURBAN(-2),3)	1.354437	0.203380	6.659636	0.0000
D(LURBAN(-3),3)	1.374896	0.172088	7.989500	0.0000
D(LURBAN(-4),3)	0.582276	0.143913	4.046041	0.0001
D(LURBAN(-5),3)	0.569715	0.120419	4.731087	0.0000
D(LURBAN(-6),3)	0.576968	0.093207	6.190192	0.0000
D(LURBAN(-7),3)	0.584035	0.057821	10.10069	0.0000
C	2.59E-05	0.000157	0.164768	0.8696
@TREND(1994Q1)	-4.85E-07	2.81E-06	-0.172911	0.8632

R-squared	0.910617	Mean dependent var	-6.31E-05
Adjusted R-squared	0.899444	S.D. dependent var	0.001873
S.E. of regression	0.000594	Akaike info criterion	-11.90557
Sum squared resid	2.54E-05	Schwarz criterion	-11.61207

Log likelihood	498.1284	Hannan-Quinn criter.	-11.78773
F-statistic	81.50244	Durbin-Watson stat	2.342443
Prob(F-statistic)	0.000000		

Null Hypothesis: LTFR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.619724	1.0000
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LTFR)
Method: Least Squares
Date: 11/15/18 Time: 22:24
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTFR(-1)	0.017177	0.010605	1.619724	0.1090
D(LTFR(-1))	0.997610	0.064636	15.43422	0.0000
C	-0.019546	0.012031	-1.624644	0.1079
@TREND(1994Q1)	5.66E-05	3.02E-05	1.876168	0.0640

R-squared	0.855999	Mean dependent var	-0.002021
Adjusted R-squared	0.850976	S.D. dependent var	0.004621
S.E. of regression	0.001784	Akaike info criterion	-9.776679
Sum squared resid	0.000274	Schwarz criterion	-9.665577
Log likelihood	443.9506	Hannan-Quinn criter.	-9.731876
F-statistic	170.4058	Durbin-Watson stat	2.289800
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LTFR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.527222	0.9993
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LTFR,2)
Method: Least Squares
Date: 11/15/18 Time: 22:25

Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTFR(-1))	0.032436	0.061522	0.527222	0.5994
C	-8.05E-05	0.000568	-0.141719	0.8876
@TREND(1994Q1)	1.01E-05	9.34E-06	1.080207	0.2830

R-squared	0.038914	Mean dependent var	0.000313
Adjusted R-squared	0.016820	S.D. dependent var	0.001816
S.E. of regression	0.001800	Akaike info criterion	-9.768852
Sum squared resid	0.000282	Schwarz criterion	-9.685525
Log likelihood	442.5983	Hannan-Quinn criter.	-9.735249
F-statistic	1.761303	Durbin-Watson stat	2.268993
Prob(F-statistic)	0.177892		

Null Hypothesis: D(LTFR,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.22312	0.0000
Test critical values:	1% level	-4.064453	
	5% level	-3.461094	
	10% level	-3.156776	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LTFR,3)
Method: Least Squares
Date: 11/15/18 Time: 22:25
Sample (adjusted): 1994Q4 2016Q4
Included observations: 89 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTFR(-1),2)	-1.104759	0.108065	-10.22312	0.0000
C	-0.000348	0.000400	-0.870304	0.3866
@TREND(1994Q1)	1.47E-05	7.54E-06	1.950864	0.0543

R-squared	0.548745	Mean dependent var	3.13E-05
Adjusted R-squared	0.538251	S.D. dependent var	0.002654
S.E. of regression	0.001803	Akaike info criterion	-9.765368
Sum squared resid	0.000280	Schwarz criterion	-9.681481
Log likelihood	437.5589	Hannan-Quinn criter.	-9.731555
F-statistic	52.28981	Durbin-Watson stat	1.953635
Prob(F-statistic)	0.000000		

Null Hypothesis: LUNOUR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.689222	0.0284

Test critical values:	1% level	-4.068290	
	5% level	-3.462912	
	10% level	-3.157836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUNOUR)
Method: Least Squares
Date: 11/15/18 Time: 22:25
Sample (adjusted): 1995Q3 2016Q4
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LUNOUR(-1)	-0.066683	0.018075	-3.689222	0.0004
D(LUNOUR(-1))	0.695859	0.102774	6.770750	0.0000
D(LUNOUR(-2))	0.225266	0.118046	1.908297	0.0600
D(LUNOUR(-3))	0.100865	0.120739	0.835402	0.4060
D(LUNOUR(-4))	-0.393584	0.120084	-3.277568	0.0016
D(LUNOUR(-5))	0.358694	0.108434	3.307964	0.0014
C	0.099044	0.026904	3.681339	0.0004
@TREND(1994Q1)	-7.15E-05	4.16E-05	-1.718956	0.0896

R-squared	0.698566	Mean dependent var	0.000730
Adjusted R-squared	0.671514	S.D. dependent var	0.014787
S.E. of regression	0.008475	Akaike info criterion	-6.615052
Sum squared resid	0.005602	Schwarz criterion	-6.386740
Log likelihood	292.4472	Hannan-Quinn criter.	-6.523167
F-statistic	25.82332	Durbin-Watson stat	2.065002
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LUNOUR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.223047	0.0865
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUNOUR,2)
Method: Least Squares
Date: 11/15/18 Time: 22:26
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LUNOUR(-1))	-0.229397	0.071174	-3.223047	0.0018
C	0.000158	0.002069	0.076237	0.9394
@TREND(1994Q1)	-5.02E-06	3.89E-05	-0.129111	0.8976

R-squared	0.107573	Mean dependent var	-0.000396
Adjusted R-squared	0.087057	S.D. dependent var	0.010019
S.E. of regression	0.009573	Akaike info criterion	-6.427010
Sum squared resid	0.007973	Schwarz criterion	-6.343683
Log likelihood	292.2155	Hannan-Quinn criter.	-6.393408
F-statistic	5.243467	Durbin-Watson stat	2.168745
Prob(F-statistic)	0.007078		

Null Hypothesis: D(LUNOUR,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.585389	0.0001
Test critical values:	1% level	-4.068290	
	5% level	-3.462912	
	10% level	-3.157836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUNOUR,3)
Method: Least Squares
Date: 11/15/18 Time: 22:26
Sample (adjusted): 1995Q3 2016Q4
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LUNOUR(-1),2)	-1.312482	0.234985	-5.585389	0.0000
D(LUNOUR(-1),3)	0.155265	0.211036	0.735727	0.4640
D(LUNOUR(-2),3)	0.228030	0.169862	1.342443	0.1832
D(LUNOUR(-3),3)	0.349805	0.106946	3.270840	0.0016
C	0.000390	0.002236	0.174396	0.8620
@TREND(1994Q1)	-1.56E-05	4.11E-05	-0.380056	0.7049

R-squared	0.673101	Mean dependent var	-8.26E-05
Adjusted R-squared	0.652669	S.D. dependent var	0.016018
S.E. of regression	0.009440	Akaike info criterion	-6.420426
Sum squared resid	0.007130	Schwarz criterion	-6.249193
Log likelihood	282.0783	Hannan-Quinn criter.	-6.351513
F-statistic	32.94471	Durbin-Watson stat	1.998881
Prob(F-statistic)	0.000000		

Null Hypothesis: LPCHE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.249848	0.4564
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCHE)
Method: Least Squares
Date: 11/15/18 Time: 22:27
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPCHE(-1)	-0.038270	0.017010	-2.249848	0.0270
D(LPCHE(-1))	0.692602	0.080073	8.649645	0.0000
C	0.208743	0.091987	2.269273	0.0258
@TREND(1994Q1)	0.000457	0.000248	1.839147	0.0693

R-squared	0.476370	Mean dependent var	0.006276
Adjusted R-squared	0.458104	S.D. dependent var	0.042825
S.E. of regression	0.031525	Akaike info criterion	-4.032650
Sum squared resid	0.085469	Schwarz criterion	-3.921547
Log likelihood	185.4692	Hannan-Quinn criter.	-3.987847
F-statistic	26.07934	Durbin-Watson stat	2.189818
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LPCHE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.875981	0.0170
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCHE,2)
Method: Least Squares
Date: 11/15/18 Time: 22:27
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCHE(-1))	-0.317066	0.081803	-3.875981	0.0002
C	0.002355	0.006972	0.337860	0.7363
@TREND(1994Q1)	-2.18E-05	0.000131	-0.165777	0.8687

R-squared	0.149004	Mean dependent var	-0.000946
Adjusted R-squared	0.129441	S.D. dependent var	0.034567
S.E. of regression	0.032252	Akaike info criterion	-3.997681
Sum squared resid	0.090499	Schwarz criterion	-3.914354
Log likelihood	182.8956	Hannan-Quinn criter.	-3.964079
F-statistic	7.616566	Durbin-Watson stat	2.118441
Prob(F-statistic)	0.000895		

Null Hypothesis: D(LPCHE,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.360178	0.0000
Test critical values:	1% level	-4.068290	
	5% level	-3.462912	
	10% level	-3.157836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCHE,3)
Method: Least Squares
Date: 11/15/18 Time: 22:27
Sample (adjusted): 1995Q3 2016Q4
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCHE(-1),2)	-1.532708	0.240985	-6.360178	0.0000
D(LPCHE(-1),3)	0.331023	0.211709	1.563577	0.1219
D(LPCHE(-2),3)	0.336016	0.166943	2.012764	0.0475
D(LPCHE(-3),3)	0.379148	0.104110	3.641805	0.0005
C	0.003374	0.007650	0.440977	0.6604
@TREND(1994Q1)	-9.11E-05	0.000141	-0.647777	0.5190

R-squared	0.685107	Mean dependent var	-0.000204
Adjusted R-squared	0.665426	S.D. dependent var	0.055828
S.E. of regression	0.032293	Akaike info criterion	-3.960749
Sum squared resid	0.083424	Schwarz criterion	-3.789515
Log likelihood	176.3122	Hannan-Quinn criter.	-3.891835
F-statistic	34.81094	Durbin-Watson stat	2.042293
Prob(F-statistic)	0.000000		

Null Hypothesis: LIWS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.937127	1.0000
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIWS)
Method: Least Squares
Date: 11/15/18 Time: 22:29
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIWS(-1)	0.041677	0.014190	2.937127	0.0043
D(LIWS(-1))	0.845708	0.081388	10.39101	0.0000
C	-0.184112	0.062699	-2.936425	0.0043
@TREND(1994Q1)	-5.74E-05	1.90E-05	-3.018553	0.0033

R-squared	0.835588	Mean dependent var	0.001196
Adjusted R-squared	0.829853	S.D. dependent var	0.000601
S.E. of regression	0.000248	Akaike info criterion	-13.72270
Sum squared resid	5.29E-06	Schwarz criterion	-13.61160
Log likelihood	621.5215	Hannan-Quinn criter.	-13.67790
F-statistic	145.6922	Durbin-Watson stat	2.233741
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LIWS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.093800	0.9943
Test critical values:	1% level	-4.063233	
	5% level	-3.460516	
	10% level	-3.156439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIWS,2)
Method: Least Squares
Date: 11/15/18 Time: 22:30
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIWS(-1))	-0.006251	0.066645	-0.093800	0.9255
C	4.36E-05	0.000133	0.329020	0.7429
@TREND(1994Q1)	-1.67E-06	1.33E-06	-1.262769	0.2100

R-squared	0.026049	Mean dependent var	-4.20E-05
Adjusted R-squared	0.003660	S.D. dependent var	0.000259
S.E. of regression	0.000259	Akaike info criterion	-13.64933
Sum squared resid	5.82E-06	Schwarz criterion	-13.56600
Log likelihood	617.2198	Hannan-Quinn criter.	-13.61573
F-statistic	1.163456	Durbin-Watson stat	2.278807
Prob(F-statistic)	0.317217		

Null Hypothesis: D(LIWS,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-10.79003	0.0000

Test critical values:	1% level	-4.064453
	5% level	-3.461094
	10% level	-3.156776

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIWS,3)
Method: Least Squares
Date: 11/15/18 Time: 22:30
Sample (adjusted): 1994Q4 2016Q4
Included observations: 89 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIWS(-1),2)	-1.157015	0.107230	-10.79003	0.0000
C	4.16E-05	5.68E-05	0.732872	0.4656
@TREND(1994Q1)	-1.90E-06	1.07E-06	-1.773290	0.0797

R-squared	0.575327	Mean dependent var	-3.67E-06
Adjusted R-squared	0.565451	S.D. dependent var	0.000389
S.E. of regression	0.000257	Akaike info criterion	-13.66403
Sum squared resid	5.67E-06	Schwarz criterion	-13.58015
Log likelihood	611.0495	Hannan-Quinn criter.	-13.63022
F-statistic	58.25440	Durbin-Watson stat	1.955310
Prob(F-statistic)	0.000000		

VECM

Vector Error Correction Estimates
Date: 11/15/18 Time: 23:04
Sample (adjusted): 1995Q1 2016Q4
Included observations: 88 after adjustments
Standard errors in ( )& t-statistics in [ ]

Cointegrating Eq:	CointEq1
LLIFE(-1)	1.000000
D(LGDP(-1))	-0.099747 (0.59862) [-0.16663]
D(LEDUA(-1))	0.715553 (0.46251) [1.54712]
D(LIWS(-1))	5.014714 (23.4349) [0.21398]
LPCHE(-1)	-0.076027 (0.03276) [-2.32088]
D(LTFR(-1))	4.401186 (3.31260) [1.32862]

LUNOUR(-1)	-0.173854
	(0.06964)
	[-2.49632]
D(LURBAN(-1))	-1.266193
	(2.71495)
	[-0.46638]
C	-3.332025

Error Correction:	D(LLIFE)	D(LGDP,2)	D(LEDUA,2)	D(LIWS,2)	D(LPCHE)	D(LTFR,2)	D(LUNOUR)	D(LURBAN,2)
CointEq1	-0.006195	0.010630	-0.039538	-0.000588	-0.012374	0.003417	0.025737	-0.000308
	(0.00165)	(0.01747)	(0.03214)	(0.00105)	(0.13503)	(0.00721)	(0.04025)	(0.00548)
	[-3.74490]	[0.60860]	[-1.23004]	[-0.56268]	[-0.09164]	[0.47388]	[0.63944]	[-0.05633]
D(LLIFE(-1))	0.672383	0.841911	-4.496396	-0.001560	13.90288	-0.243322	2.635293	0.005968
	(0.34622)	(3.65582)	(6.72776)	(0.21877)	(28.2626)	(1.50911)	(8.42417)	(1.14600)
	[1.94206]	[0.23029]	[-0.66833]	[-0.00713]	[0.49192]	[-0.16123]	[0.31283]	[0.00521]
D(LLIFE(-2))	0.302788	-0.910131	4.419462	-0.003741	-13.82917	0.264314	-2.477220	-0.007019
	(0.34227)	(3.61414)	(6.65106)	(0.21627)	(27.9404)	(1.49191)	(8.32813)	(1.13294)
	[0.88464]	[-0.25182]	[0.66447]	[-0.01730]	[-0.49495]	[0.17716]	[-0.29745]	[-0.00620]
D(LGDP(-1),2)	0.003189	-0.265681	0.046313	0.002392	0.217030	-0.019565	0.093621	0.001551
	(0.01267)	(0.13379)	(0.24621)	(0.00801)	(1.03431)	(0.05523)	(0.30829)	(0.04194)
	[0.25171]	[-1.98580]	[0.18810]	[0.29875]	[0.20983]	[-0.35426]	[0.30367]	[0.03697]
D(LGDP(-2),2)	0.001938	-0.029669	0.040251	0.001822	0.126702	-0.015237	0.050912	0.004411
	(0.01218)	(0.12860)	(0.23666)	(0.00770)	(0.99419)	(0.05309)	(0.29633)	(0.04031)
	[0.15910]	[-0.23071]	[0.17008]	[0.23674]	[0.12744]	[-0.28703]	[0.17181]	[0.10943]
D(LEDUA(-1),2)	0.002550	0.011835	-0.281551	0.000874	-0.019943	-0.006126	0.068978	0.001190
	(0.00762)	(0.08041)	(0.14798)	(0.00481)	(0.62165)	(0.03319)	(0.18529)	(0.02521)
	[0.33489]	[0.14718]	[-1.90262]	[0.18170]	[-0.03208]	[-0.18456]	[0.37226]	[0.04722]
D(LEDUA(-2),2)	0.000159	0.008531	-0.047062	-0.000138	-0.074944	-0.000125	0.024003	0.002459
	(0.00643)	(0.06790)	(0.12496)	(0.00406)	(0.52496)	(0.02803)	(0.15647)	(0.02129)
	[0.02477]	[0.12564]	[-0.37660]	[-0.03401]	[-0.14276]	[-0.00445]	[0.15340]	[0.11550]
D(LIWS(-1),2)	0.041263	-0.538617	1.590443	-0.279794	4.833977	-0.335916	1.500244	-0.051402
	(0.33018)	(3.48644)	(6.41606)	(0.20863)	(26.9532)	(1.43919)	(8.03386)	(1.09291)
	[0.12497]	[-0.15449]	[0.24788]	[-1.34109]	[0.17935]	[-0.23341]	[0.18674]	[-0.04703]
D(LIWS(-2),2)	0.038987	-0.866922	1.946736	-0.046649	5.133092	-0.326311	1.383379	-0.071744
	(0.32763)	(3.45955)	(6.36657)	(0.20702)	(26.7453)	(1.42809)	(7.97190)	(1.08448)
	[0.11900]	[-0.25059]	[0.30577]	[-0.22533]	[0.19193]	[-0.22849]	[0.17353]	[-0.06616]
D(LPCHE(-1))	-0.001202	0.007505	-0.017334	-0.000459	0.575868	0.005716	-0.007898	-0.000560
	(0.00161)	(0.01697)	(0.03124)	(0.00102)	(0.13122)	(0.00701)	(0.03911)	(0.00532)
	[-0.74758]	[0.44217]	[-0.55493]	[-0.45189]	[4.38869]	[0.81576]	[-0.20194]	[-0.10525]
D(LPCHE(-2))	-0.001178	0.012203	-0.007368	-0.000287	0.076484	0.003293	0.001651	-0.000863
	(0.00165)	(0.01740)	(0.03203)	(0.00104)	(0.13454)	(0.00718)	(0.04010)	(0.00546)
	[-0.71493]	[0.70119]	[-0.23006]	[-0.27574]	[0.56848]	[0.45835]	[0.04118]	[-0.15825]
D(LTFR(-1),2)	-0.028972	0.034517	-0.646067	-0.020474	3.393360	-0.186225	0.462055	-0.004145
	(0.09035)	(0.95403)	(1.75570)	(0.05709)	(7.37549)	(0.39382)	(2.19839)	(0.29906)
	[-0.32066]	[0.03618]	[-0.36798]	[-0.35862]	[0.46009]	[-0.47287]	[0.21018]	[-0.01386]
D(LTFR(-2),2)	-0.035100	-0.140882	0.376646	-0.029078	-0.993320	0.162775	-0.454038	-0.011568

	(0.04541)	(0.47952)	(0.88245)	(0.02869)	(3.70710)	(0.19794)	(1.10496)	(0.15032)
	[-0.77291]	[-0.29380]	[0.42682]	[-1.01334]	[-0.26795]	[0.82232]	[-0.41091]	[-0.07696]
D(LUNOUR(-1))	-0.005499	0.005729	0.051027	-0.002113	0.010908	0.020144	0.686163	-0.000599
	(0.00766)	(0.08086)	(0.14881)	(0.00484)	(0.62512)	(0.03338)	(0.18633)	(0.02535)
	[-0.71814]	[0.07085]	[0.34291]	[-0.43662]	[0.01745]	[0.60349]	[3.68259]	[-0.02363]
D(LUNOUR(-2))	-0.005391	-0.004484	0.036731	-0.002644	-0.212656	0.021034	0.098724	0.000147
	(0.00809)	(0.08542)	(0.15720)	(0.00511)	(0.66039)	(0.03526)	(0.19684)	(0.02678)
	[-0.66633]	[-0.05249]	[0.23365]	[-0.51726]	[-0.32202]	[0.59651]	[0.50155]	[0.00550]
D(LURBAN(-1),2)	-0.008931	-0.050741	-0.038391	-0.001610	-0.219157	0.017260	-0.080822	-0.295163
	(0.03764)	(0.39743)	(0.73138)	(0.02378)	(3.07245)	(0.16406)	(0.91580)	(0.12458)
	[-0.23728]	[-0.12767]	[-0.05249]	[-0.06770]	[-0.07133]	[0.10521]	[-0.08825]	[-2.36922]
D(LURBAN(-2),2)	-0.005832	-0.086217	-0.031690	-0.000568	-0.014795	0.014299	-0.080404	-0.055456
	(0.03743)	(0.39522)	(0.72732)	(0.02365)	(3.05541)	(0.16315)	(0.91072)	(0.12389)
	[-0.15582]	[-0.21815]	[-0.04357]	[-0.02402]	[-0.00484]	[0.08764]	[-0.08829]	[-0.44762]
C	4.69E-05	-0.000298	9.91E-05	-2.74E-05	0.001487	0.000178	7.82E-06	-3.55E-06
	(5.4E-05)	(0.00057)	(0.00105)	(3.4E-05)	(0.00440)	(0.00023)	(0.00131)	(0.00018)
	[0.87047]	[-0.52447]	[0.09466]	[-0.80474]	[0.33823]	[0.75736]	[0.00597]	[-0.01993]
R-squared	0.991214	0.093088	0.132008	0.134436	0.471244	0.161348	0.588351	0.083258
Adj. R-squared	0.989081	-0.127162	-0.078790	-0.075772	0.342832	-0.042324	0.488379	-0.139380
Sum sq. resids	1.30E-05	0.001444	0.004890	5.17E-06	0.086299	0.000246	0.007667	0.000142
S.E. equation	0.000430	0.004542	0.008358	0.000272	0.035112	0.001875	0.010466	0.001424
F-statistic	464.5559	0.422645	0.626228	0.639539	3.669780	0.792195	5.885153	0.373961
Log likelihood	567.3285	359.9128	306.2396	607.7265	179.9334	437.7750	286.4518	461.9964
Akaike AIC	-12.48474	-7.770745	-6.550900	-13.40287	-3.680305	-9.540341	-6.101176	-10.09083
Schwarz SC	-11.97801	-7.264017	-6.044172	-12.89615	-3.173577	-9.033613	-5.594448	-9.584099
Mean dependent	2.96E-05	-0.000102	-0.000137	-4.11E-05	0.006319	0.000316	0.000832	-9.88E-06
S.D. dependent	0.004116	0.004278	0.008047	0.000262	0.043313	0.001836	0.014632	0.001334

Determinant resid covariance (dof adj.)	1.81E-43
Determinant resid covariance	2.90E-44
Log likelihood	3411.955
Akaike information criterion	-74.08989
Schwarz criterion	-69.81085

Estimate Equation

Dependent Variable: LLIFE
Method: Least Squares
Date: 11/15/18 Time: 23:06
Sample (adjusted): 1994Q2 2016Q4
Included observations: 91 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP)	-3.203192	1.989837	-1.609776	0.1112
D(LEDUA)	0.546707	1.413314	0.386826	0.6999
D(LIWS)	-76.25140	70.93917	-1.074884	0.2855
LPCHE	0.317804	0.021071	15.08249	0.0000
D(LTFR)	-25.60678	9.112673	-2.810018	0.0062
LUNOUR	1.528709	0.091049	16.78998	0.0000
D(LURBAN)	0.679257	8.817941	0.077031	0.9388

R-squared	-2.175959	Mean dependent var	4.043097
Adjusted R-squared	-2.402813	S.D. dependent var	0.057887
S.E. of regression	0.106783	Akaike info criterion	-1.562226
Sum squared resid	0.957826	Schwarz criterion	-1.369082
Log likelihood	78.08126	Hannan-Quinn criter.	-1.484304
Durbin-Watson stat	0.214423		

VAR

Vector Autoregression Estimates
Date: 05/21/18 Time: 23:02
Sample (adjusted): 1995Q1 2016Q4
Included observations: 88 after adjustments
Standard errors in ( )& t-statistics in [ ]

	LLIFE	D(LGDP,2)	D(LEDUA,2)	D(LIWS,2)	D(LPCHE)	D(LTFR,2)	LUNOUR	D(LURBAN,2)
LLIFE(-1)	1.969487	-0.168353	0.100385	-0.018080	-0.235222	0.133189	-0.605325	0.006646
	(0.01324)	(0.15111)	(0.28039)	(0.00855)	(1.16137)	(0.05715)	(0.32362)	(0.04739)
	[148.779]	[-1.11409]	[0.35801]	[-2.11535]	[-0.20254]	[2.33039]	[-1.87046]	[0.14023]
LLIFE(-2)	-0.976077	0.168391	-0.113799	0.016579	0.112267	-0.120992	0.580897	-0.006949
	(0.01307)	(0.14915)	(0.27675)	(0.00844)	(1.14626)	(0.05641)	(0.31941)	(0.04678)
	[-74.7071]	[1.12904]	[-0.41120]	[1.96526]	[0.09794]	[-2.14490]	[1.81864]	[-0.14857]
D(LGDP(-1),2)	-0.000143	-0.269346	0.060795	0.000544	0.144130	-0.004754	0.099502	0.002246
	(0.01119)	(0.12778)	(0.23710)	(0.00723)	(0.98204)	(0.04833)	(0.27365)	(0.04007)
	[-0.01276]	[-2.10791]	[0.25641]	[0.07526]	[0.14677]	[-0.09836]	[0.36361]	[0.05606]
D(LGDP(-2),2)	0.000752	-0.033489	0.044950	0.000903	0.112275	-0.007342	-3.76E-05	0.005052
	(0.01119)	(0.12769)	(0.23693)	(0.00722)	(0.98134)	(0.04829)	(0.27346)	(0.04005)
	[0.06725]	[-0.26227]	[0.18972]	[0.12503]	[0.11441]	[-0.15203]	[-0.00014]	[0.12617]
D(LEDUA(-1),2)	8.74E-05	0.016598	-0.278793	0.000361	-0.085284	-0.002907	0.162867	0.000869
	(0.00598)	(0.06829)	(0.12672)	(0.00386)	(0.52487)	(0.02583)	(0.14626)	(0.02142)
	[0.01460]	[0.24304]	[-2.20006]	[0.09356]	[-0.16249]	[-0.11256]	[1.11356]	[0.04058]
D(LEDUA(-2),2)	0.000725	0.012605	-0.053915	0.000500	-0.060193	-0.005568	0.053578	0.002116
	(0.00591)	(0.06744)	(0.12513)	(0.00381)	(0.51829)	(0.02551)	(0.14443)	(0.02115)
	[0.12279]	[0.18692]	[-0.43086]	[0.13104]	[-0.11614]	[-0.21832]	[0.37097]	[0.10007]
D(LIWS(-1),2)	0.027112	-0.659153	1.729116	-0.293766	4.351651	-0.211564	0.446288	-0.045594
	(0.30282)	(3.45680)	(6.41419)	(0.19552)	(26.5672)	(1.30741)	(7.40312)	(1.08412)
	[0.08953]	[-0.19068]	[0.26958]	[-1.50248]	[0.16380]	[-0.16182]	[0.06028]	[-0.04206]
D(LIWS(-2),2)	0.041501	-0.917006	2.068212	-0.050472	4.782914	-0.288503	1.071283	-0.070199
	(0.30055)	(3.43087)	(6.36608)	(0.19405)	(26.3679)	(1.29761)	(7.34759)	(1.07599)
	[0.13808]	[-0.26728]	[0.32488]	[-0.26009]	[0.18139]	[-0.22233]	[0.14580]	[-0.06524]
D(LPCHE(-1))	-0.000935	0.007634	-0.016917	-0.000316	0.574642	0.004545	-0.001605	-0.000679
	(0.00148)	(0.01686)	(0.03129)	(0.00095)	(0.12958)	(0.00638)	(0.03611)	(0.00529)
	[-0.63324]	[0.45278]	[-0.54074]	[-0.33112]	[4.43459]	[0.71269]	[-0.04445]	[-0.12836]
D(LPCHE(-2))	-0.001175	0.008589	-0.000894	-0.000588	0.061359	0.006036	-0.019917	-0.000760
	(0.00150)	(0.01711)	(0.03175)	(0.00097)	(0.13151)	(0.00647)	(0.03665)	(0.00537)
	[-0.78391]	[0.50195]	[-0.02816]	[-0.60705]	[0.46658]	[0.93263]	[-0.54350]	[-0.14171]
D(LTFR(-1),2)	0.057043	-0.048785	0.280946	-0.007744	0.668017	-0.249916	1.271430	-0.011746
	(0.04372)	(0.49905)	(0.92600)	(0.02823)	(3.83545)	(0.18875)	(1.06877)	(0.15651)

	[1.30481]	[-0.09776]	[0.30340]	[-0.27434]	[0.17417]	[-1.32407]	[1.18962]	[-0.07505]
D(LTFR(-2),2)	0.000671	-0.047848	0.271094	-0.010193	-0.181497	0.003557	0.265590	-0.016899
	(0.04253)	(0.48550)	(0.90085)	(0.02746)	(3.73126)	(0.18362)	(1.03974)	(0.15226)
	[0.01578]	[-0.09856]	[0.30093]	[-0.37117]	[-0.04864]	[0.01937]	[0.25544]	[-0.11099]
LUNOUR(-1)	-0.003623	0.004766	0.094478	-0.002664	-0.069013	0.024427	1.808016	-0.000288
	(0.00331)	(0.03784)	(0.07021)	(0.00214)	(0.29080)	(0.01431)	(0.08103)	(0.01187)
	[-1.09296]	[0.12596]	[1.34569]	[-1.24491]	[-0.23732]	[1.70690]	[22.3122]	[-0.02424]
LUNOUR(-2)	0.000921	-0.012385	-0.087355	0.001059	0.026016	-0.010897	-0.881713	0.000998
	(0.00356)	(0.04065)	(0.07543)	(0.00230)	(0.31244)	(0.01538)	(0.08706)	(0.01275)
	[0.25864]	[-0.30466]	[-1.15805]	[0.46055]	[0.08327]	[-0.70872]	[-10.1272]	[0.07828]
D(LURBAN(-1),2)	-0.000332	-0.054782	-0.000169	0.000508	-0.214739	0.001418	-0.035734	-0.295757
	(0.03448)	(0.39357)	(0.73028)	(0.02226)	(3.02478)	(0.14885)	(0.84288)	(0.12343)
	[-0.00962]	[-0.13919]	[-0.00023]	[0.02283]	[-0.07099]	[0.00952]	[-0.04239]	[-2.39611]
D(LURBAN(-2),2)	-5.33E-06	-0.080656	-0.022614	0.001681	0.028613	-0.003958	0.008993	-0.056284
	(0.03435)	(0.39214)	(0.72763)	(0.02218)	(3.01379)	(0.14831)	(0.83981)	(0.12298)
	[-0.00016]	[-0.20568]	[-0.03108]	[0.07578]	[0.00949]	[-0.02669]	[0.01071]	[-0.45765]
C	0.030513	0.010526	0.043764	0.008337	0.560558	-0.068485	0.204407	0.000204
	(0.00460)	(0.05251)	(0.09744)	(0.00297)	(0.40358)	(0.01986)	(0.11246)	(0.01647)
	[6.63305]	[0.20045]	[0.44915]	[2.80680]	[1.38896]	[-3.44825]	[1.81759]	[0.01241]
R-squared	0.999961	0.094952	0.119385	0.228306	0.478507	0.297426	0.984976	0.084280
Adj. R-squared	0.999952	-0.109002	-0.079063	0.054403	0.360988	0.139100	0.981590	-0.122079
Sum sq. resids	1.11E-05	0.001441	0.004961	4.61E-06	0.085114	0.000206	0.006609	0.000142
S.E. equation	0.000395	0.004505	0.008359	0.000255	0.034623	0.001704	0.009648	0.001413
F-statistic	113030.9	0.465556	0.601594	1.312834	4.071728	1.878564	290.9153	0.408413
Log likelihood	574.2798	360.0033	305.6044	612.7774	180.5420	445.5650	292.9862	462.0455
Akaike AIC	-12.66545	-7.795530	-6.559190	-13.54039	-3.716864	-9.740113	-6.272414	-10.11467
Schwarz SC	-12.18687	-7.316954	-6.080614	-13.06182	-3.238288	-9.261537	-5.793837	-9.636094
Mean dependent	4.040367	-0.000102	-0.000137	-4.11E-05	0.006319	0.000316	1.440169	-9.88E-06
S.D. dependent	0.056901	0.004278	0.008047	0.000262	0.043313	0.001836	0.071107	0.001334

Determinant resid covariance (dof adj.)	1.67E-43
Determinant resid covariance	3.01E-44
Log likelihood	3410.428
Akaike information criterion	-74.41882
Schwarz criterion	-70.59021

Method: Least Squares
Date: 05/21/18 Time: 22:34
Sample (adjusted): 1995Q1 2016Q4
Included observations: 88 after adjustments
D(LLIFE) = C(1)*(LLIFE(-1) - 0.0997473710346*D(LGDP(-1)) + 0.715553397924*D(LEDUA(-1)) + 5.01471359785*D(LIWS(-1)) - 0.0760273126945*LPCHE(-1) + 4.40118619432*D(LTFR(-1)) - 0.173853732537*LUNOUR(-1) - 1.26619341811*D(LURBAN(-1)) - 3.33202492956) + C(2)*D(LLIFE(-1)) + C(3)*D(LLIFE(-2)) + C(4)*D(LGDP(-1),2) + C(5)*D(LGDP(-2),2) + C(6)*D(LEDUA(-1),2) + C(7)*D(LEDUA(-2),2) + C(8)*D(LIWS(-1),2) + C(9)*D(LIWS(-2),2) + C(10)*D(LPCHE(-1)) + C(11)*D(LPCHE(-2)) + C(12)*D(LTFR(-1),2) + C(13)*D(LTFR(-2),2) + C(14)*D(LUNOUR(-1)) + C(15)*D(LUNOUR(-2)) + C(16)*D(LURBAN(-1),2) + C(17)*D(LURBAN(-2),2) + C(18)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.006195	0.001654	-3.744897	0.0004
C(2)	0.672383	0.346222	1.942059	0.0562
C(3)	0.302788	0.342274	0.884636	0.3794
C(4)	0.003189	0.012670	0.251706	0.8020
C(5)	0.001938	0.012179	0.159098	0.8740
C(6)	0.002550	0.007615	0.334889	0.7387
C(7)	0.000159	0.006431	0.024769	0.9803
C(8)	0.041263	0.330181	0.124972	0.9009
C(9)	0.038987	0.327634	0.118996	0.9056
C(10)	-0.001202	0.001607	-0.747583	0.4572
C(11)	-0.001178	0.001648	-0.714934	0.4770
C(12)	-0.028972	0.090351	-0.320662	0.7494
C(13)	-0.035100	0.045413	-0.772906	0.4422
C(14)	-0.005499	0.007658	-0.718136	0.4751
C(15)	-0.005391	0.008090	-0.666332	0.5074
C(16)	-0.008931	0.037638	-0.237284	0.8131
C(17)	-0.005832	0.037429	-0.155817	0.8766
C(18)	4.69E-05	5.39E-05	0.870471	0.3870

R-squared	0.991214	Mean dependent var	2.96E-05
Adjusted R-squared	0.989081	S.D. dependent var	0.004116
S.E. of regression	0.000430	Akaike info criterion	-12.48474
Sum squared resid	1.30E-05	Schwarz criterion	-11.97801
Log likelihood	567.3285	Hannan-Quinn criter.	-12.28059
F-statistic	464.5559	Durbin-Watson stat	2.071514
Prob(F-statistic)	0.000000		

GRANGER CAUSALITY

Pairwise Granger Causality Tests
Date: 05/21/18 Time: 23:48
Sample: 1994Q1 2016Q4
Lags: 8

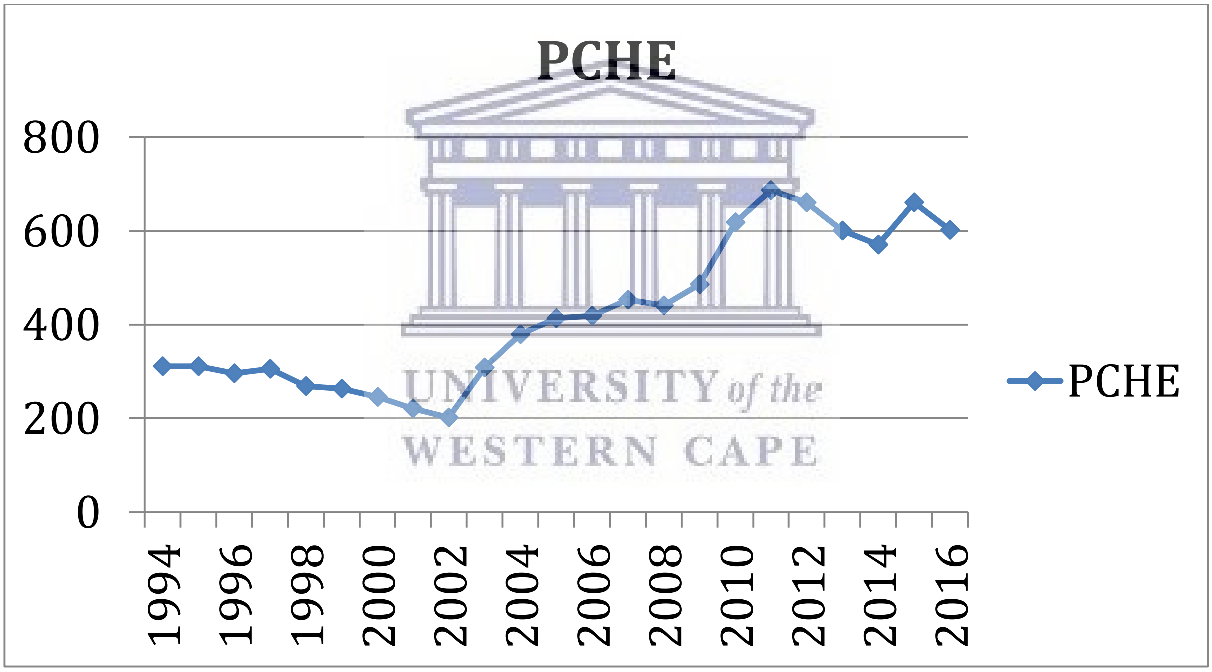
Null Hypothesis:	Obs	F-Statistic	Prob.
D(LGDP,2) does not Granger Cause LLIFE	82	0.02960	1.0000
LLIFE does not Granger Cause D(LGDP,2)		0.12236	0.9981
D(LEDUA,2) does not Granger Cause LLIFE	82	0.12520	0.9980

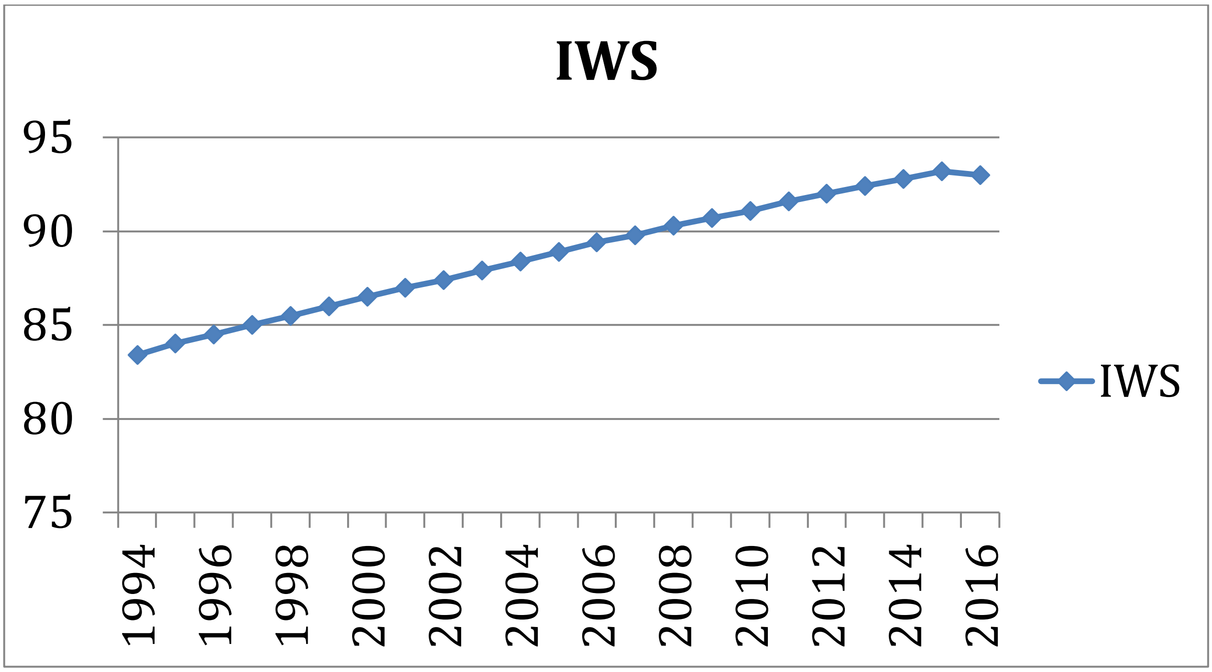
LLIFE does not Granger Cause D(LEDUA,2)		0.01789	1.0000
D(LIWS,2) does not Granger Cause LLIFE	82	0.44283	0.8908
LLIFE does not Granger Cause D(LIWS,2)		2.20115	0.0386
D(LPCHE) does not Granger Cause LLIFE	83	0.69253	0.6967
LLIFE does not Granger Cause D(LPCHE)		1.20681	0.3089
D(LTFR,2) does not Granger Cause LLIFE	82	4.19298	0.0004
LLIFE does not Granger Cause D(LTFR,2)		1.82378	0.0884
LUNOUR does not Granger Cause LLIFE	84	5.34196	3.E-05
LLIFE does not Granger Cause LUNOUR		3.39710	0.0025
D(LURBAN,2) does not Granger Cause LLIFE	82	0.25712	0.9772
LLIFE does not Granger Cause D(LURBAN,2)		0.06223	0.9998
D(LEDUA,2) does not Granger Cause D(LGDP,2)	82	0.67443	0.7121
D(LGDP,2) does not Granger Cause D(LEDUA,2)		1.20369	0.3109
D(LIWS,2) does not Granger Cause D(LGDP,2)	82	2.37524	0.0261
D(LGDP,2) does not Granger Cause D(LIWS,2)		0.85636	0.5575
D(LPCHE) does not Granger Cause D(LGDP,2)	82	0.53732	0.8241
D(LGDP,2) does not Granger Cause D(LPCHE)		1.46747	0.1865
D(LTFR,2) does not Granger Cause D(LGDP,2)	82	0.36085	0.9373
D(LGDP,2) does not Granger Cause D(LTFR,2)		0.12897	0.9978
LUNOUR does not Granger Cause D(LGDP,2)	82	0.31547	0.9575
D(LGDP,2) does not Granger Cause LUNOUR		0.04632	1.0000
D(LURBAN,2) does not Granger Cause D(LGDP,2)	82	0.85295	0.5603
D(LGDP,2) does not Granger Cause D(LURBAN,2)		0.39461	0.9196
D(LIWS,2) does not Granger Cause D(LEDUA,2)	82	0.92081	0.5053
D(LEDUA,2) does not Granger Cause D(LIWS,2)		0.43089	0.8983
D(LPCHE) does not Granger Cause D(LEDUA,2)	82	1.23801	0.2917
D(LEDUA,2) does not Granger Cause D(LPCHE)		1.03321	0.4207
D(LTFR,2) does not Granger Cause D(LEDUA,2)	82	0.27728	0.9712
D(LEDUA,2) does not Granger Cause D(LTFR,2)		0.15249	0.9960
LUNOUR does not Granger Cause D(LEDUA,2)	82	0.42556	0.9016
D(LEDUA,2) does not Granger Cause LUNOUR		0.24028	0.9816
D(LURBAN,2) does not Granger Cause D(LEDUA,2)	82	0.14519	0.9966
D(LEDUA,2) does not Granger Cause D(LURBAN,2)		0.97260	0.4652
D(LPCHE) does not Granger Cause D(LIWS,2)	82	0.12837	0.9978
D(LIWS,2) does not Granger Cause D(LPCHE)		0.24309	0.9809
D(LTFR,2) does not Granger Cause D(LIWS,2)	82	3.33784	0.0029
D(LIWS,2) does not Granger Cause D(LTFR,2)		0.02259	1.0000
LUNOUR does not Granger Cause D(LIWS,2)	82	0.93187	0.4966
D(LIWS,2) does not Granger Cause LUNOUR		1.75829	0.1018
D(LURBAN,2) does not Granger Cause D(LIWS,2)	82	0.05417	0.9999
D(LIWS,2) does not Granger Cause D(LURBAN,2)		0.49515	0.8554

D(LTFR,2) does not Granger Cause D(LPCHE)	82	0.83388	0.5762
D(LPCHE) does not Granger Cause D(LTFR,2)		0.37791	0.9286
LUNOUR does not Granger Cause D(LPCHE)	83	1.41879	0.2053
D(LPCHE) does not Granger Cause LUNOUR		0.49974	0.8521
D(LURBAN,2) does not Granger Cause D(LPCHE)	82	0.42517	0.9018
D(LPCHE) does not Granger Cause D(LURBAN,2)		0.27809	0.9709
LUNOUR does not Granger Cause D(LTFR,2)	82	2.75520	0.0110
D(LTFR,2) does not Granger Cause LUNOUR		3.56868	0.0017
D(LURBAN,2) does not Granger Cause D(LTFR,2)	82	0.39731	0.9181
D(LTFR,2) does not Granger Cause D(LURBAN,2)		1.36836	0.2271
D(LURBAN,2) does not Granger Cause LUNOUR	82	0.62429	0.7544
LUNOUR does not Granger Cause D(LURBAN,2)		1.65134	0.1277

Null Hypothesis:	F-Statistic	Prob.	Remark	Null Hypothesis:	F-Statistic	Prob.	Remark
D(LGDP,2)--> LLIFE	0.02960	1.0000	DNR	D(LPCHE) --> D(LEDUA,2)	1.23801	0.2917	DNR
LLIFE --> D(LGDP,2)	0.12236	0.9981	DNR	D(LEDUA,2) --> D(LPCHE)	1.03321	0.4207	DNR
D(LEDUA,2) --> LLIFE	0.12520	0.9980	DNR	D(LTFR,2) --> D(LEDUA,2)	0.27728	0.9712	DNR
LLIFE --> D(LEDUA,2)	0.01789	1.0000	DNR	D(LEDUA,2) --> D(LTFR,2)	0.15249	0.9960	DNR
D(LIWS,2) --> LLIFE	0.44283	0.8908	DNR	LUNOUR --> D(LEDUA,2)	0.42556	0.9016	DNR
LLIFE --> D(LIWS,2)	2.20115	0.0386	Reject	D(LEDUA,2) --> LUNOUR	0.24028	0.9816	DNR
D(LPCHE)--> LLIFE	0.69253	0.6967	DNR	D(LURBAN,2) --> D(LEDUA,2)	0.14519	0.9966	DNR
LLIFE --> D(LPCHE)	1.20681	0.3089	DNR	D(LEDUA,2) --> D(LURBAN,2)	0.97260	0.4652	DNR
D(LTFR,2) --> LLIFE	4.19298	0.0004	Reject	D(LPCHE) --> D(LIWS,2)	0.12837	0.9978	DNR
LLIFE --> D(LTFR,2)	1.82378	0.0884	DNR	D(LIWS,2) --> D(LPCHE)	0.24309	0.9809	DNR
LUNOUR --> LLIFE	5.34196	3.E-05	DNR	D(LTFR,2) --> D(LIWS,2)	3.33784	0.0029	Reject
LLIFE --> LUNOUR	3.39710	0.0025	Reject	D(LIWS,2) --> D(LTFR,2)	0.02259	1.0000	DNR
D(LURBAN,2) --> LLIFE	0.25712	0.9772	DNR	LUNOUR --> D(LIWS,2)	0.93187	0.4966	DNR
LLIFE --> D(LURBAN,2)	0.06223	0.9998	DNR	D(LIWS,2)--> LUNOUR	1.75829	0.1018	DNR
D(LEDUA,2) --> D(LGDP,2)	0.67443	0.7121	DNR	D(LURBAN,2) --> D(LIWS,2)	0.05417	0.9999	DNR
D(LGDP,2) --> D(LEDUA,2)	1.20369	0.3109	DNR	D(LIWS,2) --> D(LURBAN,2)	0.49515	0.8554	DNR
D(LIWS,2) --> D(LGDP,2)	2.37524	0.0261	Reject	D(LTFR,2) --> D(LPCHE)	0.83388	0.5762	DNR
D(LGDP,2) --> D(LIWS,2)	0.85636	0.5575	DNR	D(LPCHE) --> D(LTFR,2)	0.37791	0.9286	DNR
D(LPCHE) --> D(LGDP,2)	0.53732	0.8241	DNR	LUNOUR --> D(LPCHE)	1.41879	0.2053	DNR

D(LGDP,2) --> D(LPCHE)	1.46747	0.1865	DNR	D(LPCHE) --> LUNOUR	0.49974	0.8521	DNR
D(LTFR,2) -->e D(LGDP,2)	0.36085	0.9373	DNR	D(LURBAN,2) --> D(LPCHE)	0.42517	0.9018	DNR
D(LGDP,2) --> D(LTFR,2)	0.12897	0.9978	DNR	D(LPCHE) --> D(LURBAN,2)	0.27809	0.9709	DNR
LUNOUR -->e D(LGDP,2)	0.31547	0.9575	DNR	LUNOUR --> D(LTFR,2)	2.75520	0.0110	Reject
D(LGDP,2) --> LUNOUR	0.04632	1.0000	DNR	D(LTFR,2) --> LUNOUR	3.56868	0.0017	Reject
D(LURBAN,2)--> D(LGDP,2)	0.85295	0.5603	DNR	D(LURBAN,2) --> D(LTFR,2)	0.39731	0.9181	DNR
D(LGDP,2) --> D(LURBAN,2)	0.39461	0.9196	DNR	D(LTFR,2) --> D(LURBAN,2)	1.36836	0.2271	DNR
D(LIWS,2) --> D(LEDUA,2)	0.92081	0.5053	DNR	D(LURBAN,2) --> LUNOUR	0.62429	0.7544	DNR
D(LEDUA,2) --> D(LIWS,2)	0.43089	0.8983	DNR	LUNOUR --> D(LURBAN,2)	1.65134	0.1277	DNR

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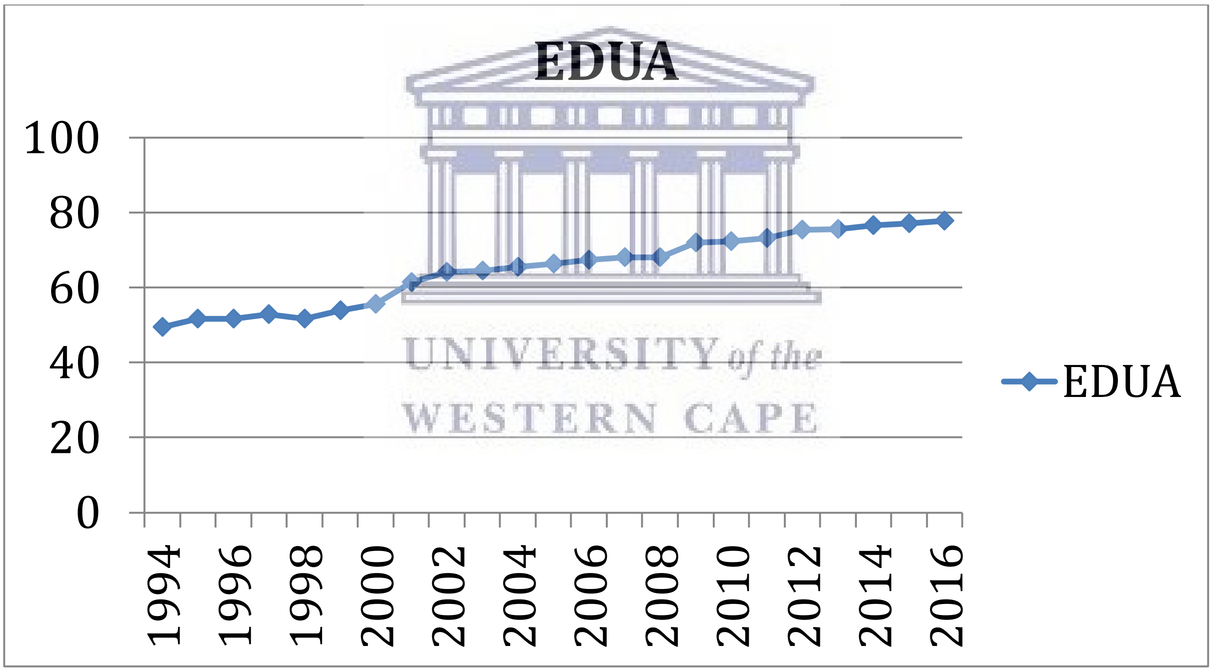
IWS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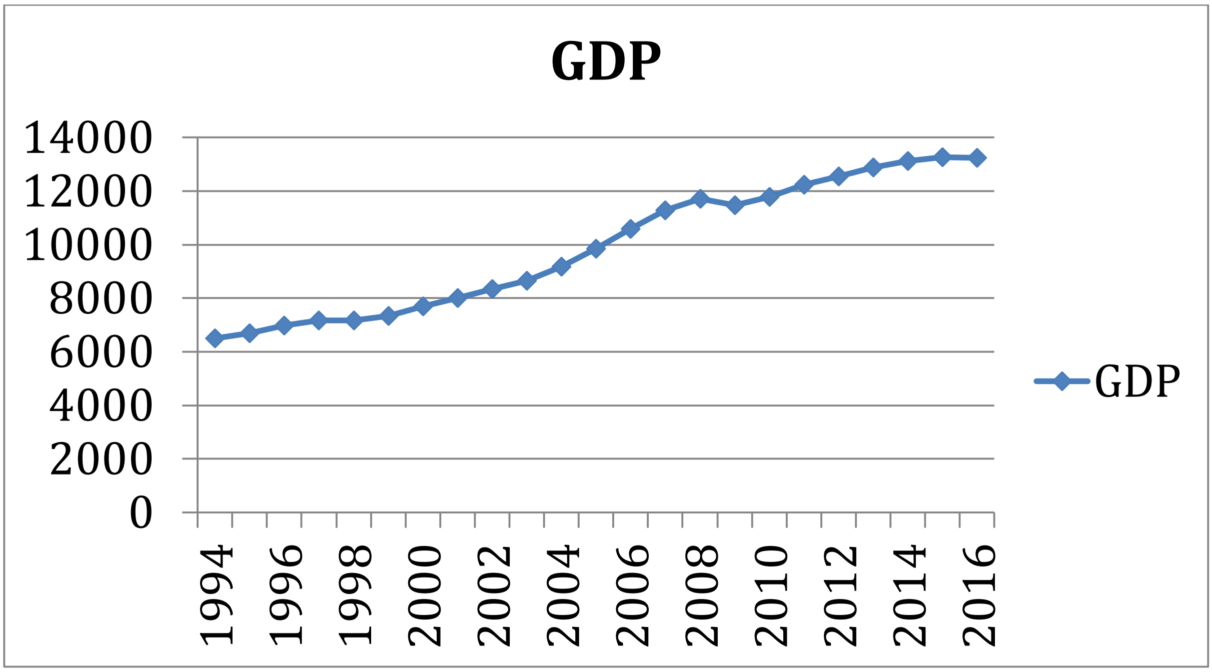
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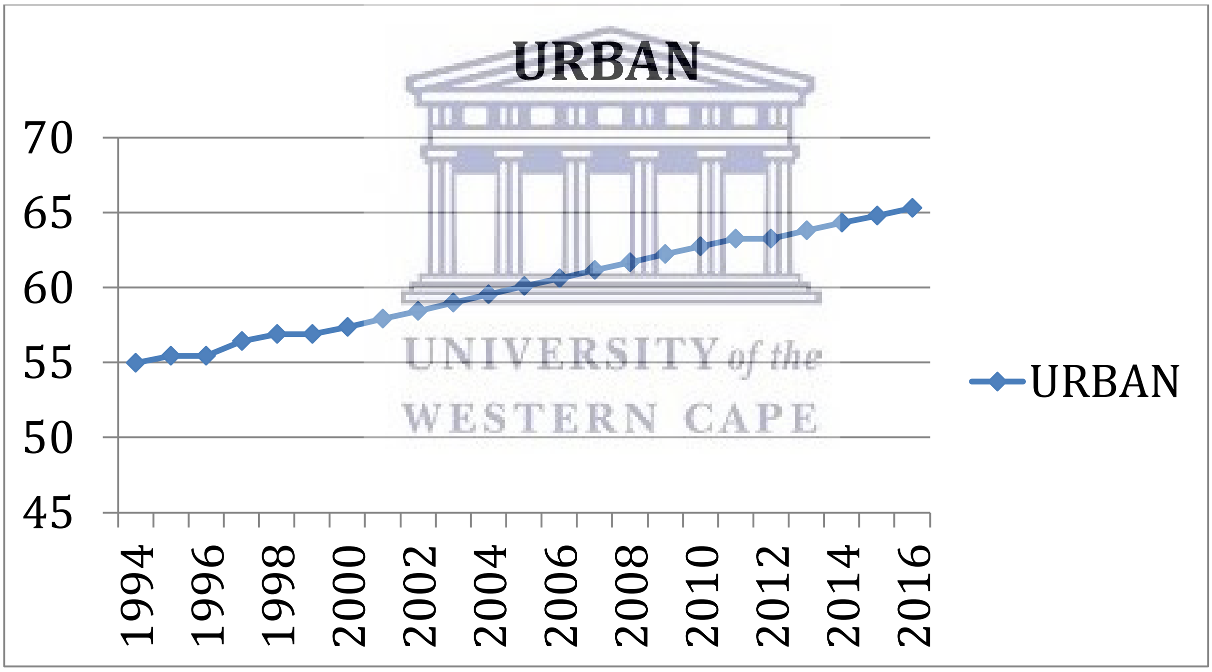
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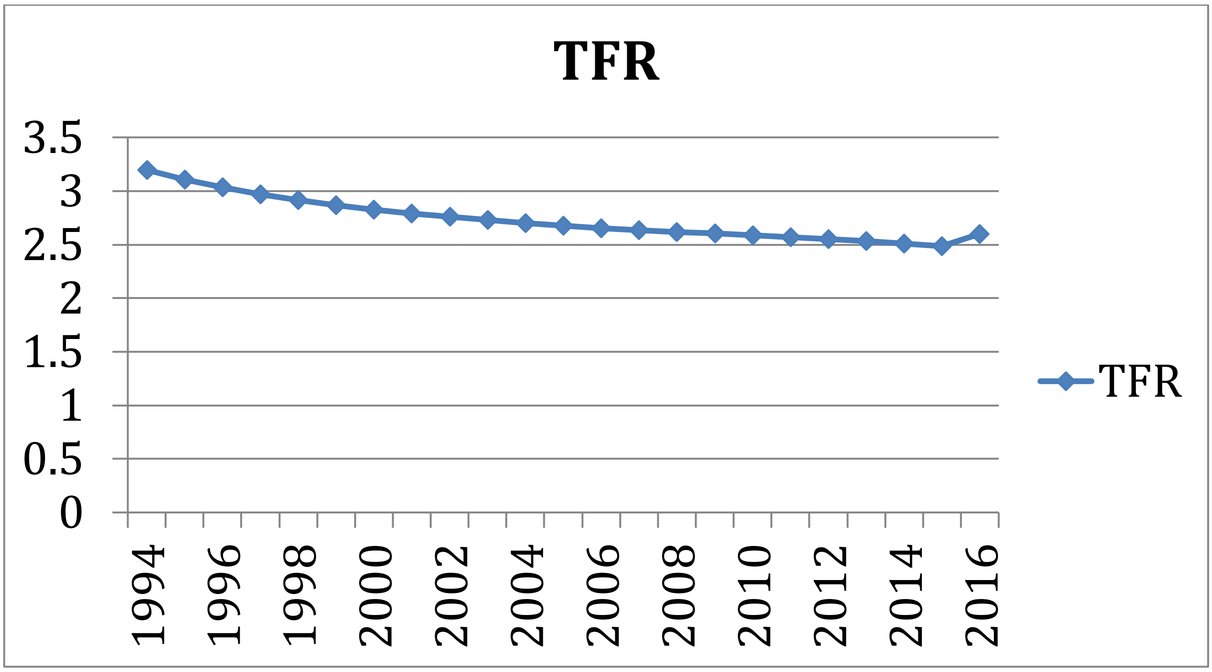
URBAN



TFR
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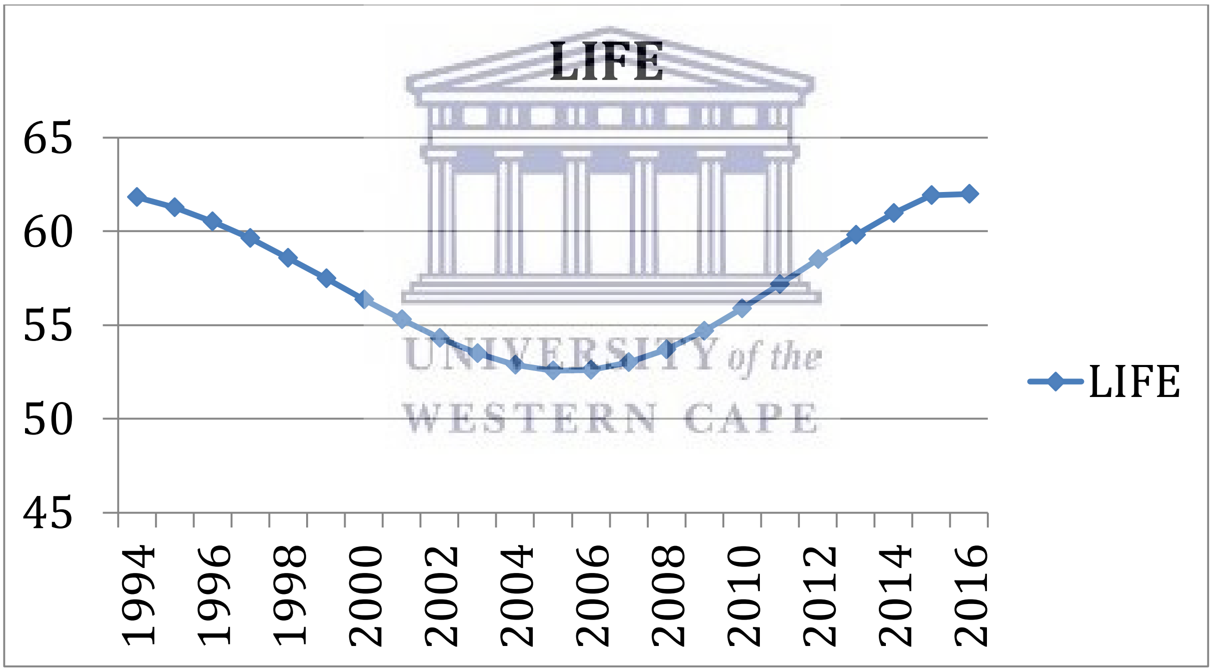
TFR



LIFE
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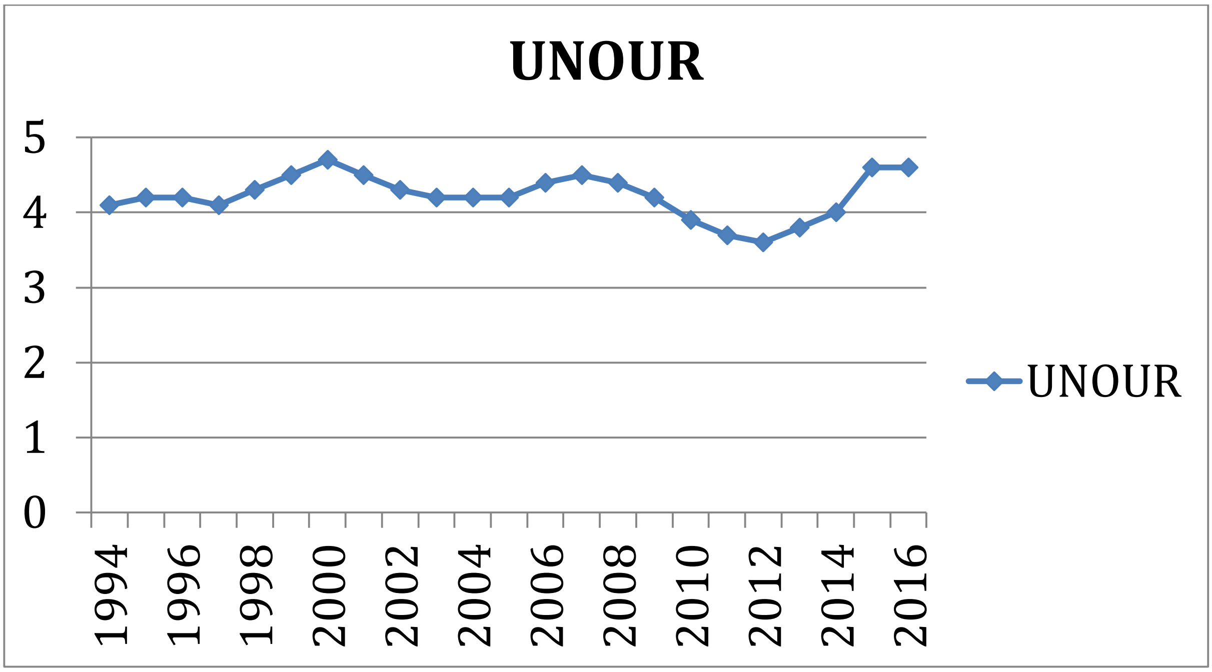
LIFE



Impulse Response

Estimate VECM

Vector Error Correction Estimates
Date: 02/20/19 Time: 21:49
Sample (adjusted): 1994Q4 2016Q4
Included observations: 89 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LLIFE(-1)	1.000000
LIWS(-1)	2.704275 (2.77920) [0.97304]
LGDP(-1)	-0.144650 (0.17957) [-0.80552]
LEDUA(-1)	-0.176660 (0.15882) [-1.11230]
LPCHE(-1)	-0.056944 (0.03369) [-1.69032]
LTFR(-1)	-0.068826 (0.52220) [-0.13180]
LUNOUR(-1)	-0.123386 (0.07894)

	[-1.56304]
LURBAN(-1)	-0.527168
	(1.33125)
	[-0.39600]
C	-11.36371

Error Correction:	D(LLIFE)	D(LIWS)	D(LGDP)	D(LEDUA)	D(LPCHE)	D(LTFR)	D(
CointEq1	-0.006351	-0.001045	-0.014915	0.003709	-0.134203	0.002232	
	(0.00176)	(0.00109)	(0.01818)	(0.03262)	(0.14717)	(0.00766)	
	[-3.61781]	[-0.95654]	[-0.82044]	[0.11370]	[-0.91191]	[0.29142]	
D(LLIFE(-1))	0.618389	0.027015	-0.180513	0.050093	11.47339	-0.247100	
	(0.33152)	(0.20638)	(3.43293)	(6.15983)	(27.7915)	(1.44646)	
	[1.86534]	[0.13090]	[-0.05258]	[0.00813]	[0.41284]	[-0.17083]	
D(LLIFE(-2))	0.376933	-0.027818	-0.002974	-0.172894	-11.60016	0.210495	
	(0.32959)	(0.20518)	(3.41297)	(6.12401)	(27.6299)	(1.43805)	
	[1.14365]	[-0.13558]	[-0.00087]	[-0.02823]	[-0.41984]	[0.14638]	
D(LIWS(-1))	0.119971	0.490099	0.018448	4.177649	-15.73859	-0.597687	
	(0.34333)	(0.21374)	(3.55526)	(6.37934)	(28.7818)	(1.49800)	
	[0.34943]	[2.29301]	[0.00519]	[0.65487]	[-0.54682]	[-0.39899]	
D(LIWS(-2))	0.088294	0.063300	-1.040322	6.866291	-19.60961	-0.413708	
	(0.34749)	(0.21632)	(3.59830)	(6.45656)	(29.1302)	(1.51614)	
	[0.25410]	[0.29262]	[-0.28911]	[1.06346]	[-0.67317]	[-0.27287]	
D(LGDP(-1))	0.006080	0.004781	0.597231	-0.023182	-0.080418	-0.029799	
	(0.01259)	(0.00783)	(0.13032)	(0.23384)	(1.05502)	(0.05491)	
	[0.48312]	[0.61028]	[4.58276]	[-0.09914]	[-0.07622]	[-0.54267]	
D(LGDP(-2))	-0.003935	-0.001471	0.143395	-0.019948	-0.670715	0.010162	
	(0.01259)	(0.00784)	(0.13041)	(0.23400)	(1.05577)	(0.05495)	
	[-0.31246]	[-0.18757]	[1.09955]	[-0.08525]	[-0.63529]	[0.18493]	
D(LEDUA(-1))	2.39E-05	0.000319	0.052144	0.422275	-0.072235	0.000407	
	(0.00794)	(0.00494)	(0.08222)	(0.14753)	(0.66564)	(0.03464)	
	[0.00301]	[0.06462]	[0.63418]	[2.86221]	[-0.10852]	[0.01176]	
D(LEDUA(-2))	-0.004927	-0.004573	0.032540	0.106723	-0.316594	0.018874	
	(0.00759)	(0.00472)	(0.07856)	(0.14097)	(0.63601)	(0.03310)	
	[-0.64949]	[-0.96814]	[0.41419]	[0.75707]	[-0.49778]	[0.57017]	
D(LPCHE(-1))	-0.001141	-0.000581	0.001673	-0.011429	0.543782	0.005082	
	(0.00153)	(0.00095)	(0.01581)	(0.02837)	(0.12799)	(0.00666)	
	[-0.74719]	[-0.61140]	[0.10583]	[-0.40288]	[4.24873]	[0.76285]	
D(LPCHE(-2))	-0.001527	-0.000225	0.016936	-0.016811	0.091418	0.005767	
	(0.00156)	(0.00097)	(0.01617)	(0.02901)	(0.13088)	(0.00681)	
	[-0.97788]	[-0.23154]	[1.04759]	[-0.57954]	[0.69851]	[0.84663]	
D(LTFR(-1))	-0.023745	-0.032854	-0.150501	0.284839	0.721974	0.679030	
	(0.09061)	(0.05641)	(0.93828)	(1.68359)	(7.59592)	(0.39534)	
	[-0.26206]	[-0.58244]	[-0.16040]	[0.16919]	[0.09505]	[1.71757]	
D(LTFR(-2))	-0.003846	-0.047233	-0.025711	1.025440	-7.072345	0.406410	
	(0.09157)	(0.05700)	(0.94821)	(1.70140)	(7.67626)	(0.39952)	
	[-0.04200]	[-0.82858]	[-0.02712]	[0.60270]	[-0.92133]	[1.01723]	

D(LUNOUR(-1))	-0.002057	-0.001667	0.022183	-0.044621	0.047721	0.016269
	(0.00734)	(0.00457)	(0.07602)	(0.13641)	(0.61546)	(0.03203)
	[-0.28013]	[-0.36481]	[0.29179]	[-0.32710]	[0.07754]	[0.50788]
D(LUNOUR(-2))	-0.007381	-0.004923	0.006909	0.067150	-0.328994	0.035573
	(0.00771)	(0.00480)	(0.07988)	(0.14334)	(0.64671)	(0.03366)
	[-0.95673]	[-1.02505]	[0.08649]	[0.46846]	[-0.50872]	[1.05685]
D(LURBAN(-1))	-0.003241	-0.005299	-0.285222	-0.057697	-0.175755	0.017182
	(0.03942)	(0.02454)	(0.40821)	(0.73247)	(3.30472)	(0.17200)
	[-0.08221]	[-0.21594]	[-0.69871]	[-0.07877]	[-0.05318]	[0.09990]
D(LURBAN(-2))	-0.004426	0.001004	-0.286566	-0.414126	0.070145	0.015464
	(0.03932)	(0.02448)	(0.40716)	(0.73058)	(3.29616)	(0.17155)
	[-0.11256]	[0.04100]	[-0.70382]	[-0.56685]	[0.02128]	[0.09014]
C	-0.000274	0.000330	0.003371	-0.006861	0.038239	0.001712
	(0.00033)	(0.00021)	(0.00343)	(0.00615)	(0.02773)	(0.00144)
	[-0.82881]	[1.60361]	[0.98398]	[-1.11628]	[1.37891]	[1.18648]
R-squared	0.992178	0.858235	0.679699	0.354398	0.502244	0.882515
Adj. R-squared	0.990305	0.824291	0.603008	0.199817	0.383063	0.854385
Sum sq. resids	1.16E-05	4.48E-06	0.001240	0.003991	0.081245	0.000220
S.E. equation	0.000404	0.000251	0.004179	0.007498	0.033827	0.001761
F-statistic	529.7535	25.28408	8.862746	2.292638	4.214129	31.37248
Log likelihood	579.3305	621.5117	371.2935	319.2609	185.1664	448.2158
Akaike AIC	-12.61417	-13.56206	-7.939179	-6.769908	-3.756548	-9.667771
Schwarz SC	-12.11085	-13.05874	-7.435859	-6.266588	-3.253228	-9.164451
Mean dependent	7.33E-06	0.001188	0.007955	0.005016	0.006281	-0.001963
S.D. dependent	0.004098	0.000599	0.006632	0.008382	0.043067	0.004614

Determinant resid covariance (dof adj.)	5.13E-44
Determinant resid covariance	8.41E-45
Log likelihood	3505.886
Akaike information criterion	-75.36823
Schwarz criterion	-71.11797

Vector Error Correction Estimates

Date: 02/20/19 Time: 21:49

Sample (adjusted): 1994Q4 2016Q4

Included observations: 89 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq: CointEq1

LLIFE(-1)	1.000000
LIWS(-1)	2.704275
	(2.77920)
	[0.97304]
LGDP(-1)	-0.144650
	(0.17957)
	[-0.80552]
LEDUA(-1)	-0.176660
	(0.15882)
	[-1.11230]
LPCHE(-1)	-0.056944
	(0.03369)
	[-1.69032]
LTFR(-1)	-0.068826
	(0.52220)
	[-0.13180]

LUNOUR(-1) -0.123386

(0.07894)

[-1.56304]

LURBAN(-1) -0.527168

(1.33125)

[-0.39600]

C -11.36371

Error Correction: D(LLIFE) D(LIWS) D(LGDP) D(LEDUA) D(LPCHE) D(LTFR) D(LUNOUR) D(LURBAN)

CointEq1 -0.006351 -0.001045 -0.014915 0.003709 -0.134203 0.002232 0.039476 -0.001150

(0.00176) (0.00109) (0.01818) (0.03262) (0.14717) (0.00766) (0.04426) (0.00540)

[-3.61781] [-0.95654] [-0.82044] [0.11370] [-0.91191] [0.29142] [0.89190] [-0.21312]

D(LLIFE(-1)) 0.618389 0.027015 -0.180513 0.050093 11.47339 -0.247100 3.617206 0.185260

(0.33152) (0.20638) (3.43293) (6.15983) (27.7915) (1.44646) (8.35819) (1.01907)

[1.86534] [0.13090] [-0.05258] [0.00813] [0.41284] [-0.17083]
[0.43277] [0.18179]

D(LLIFE(-2)) 0.376933 -0.027818 -0.002974 -0.172894 -11.60016
0.210495 -3.269349 -0.201959

(0.32959) (0.20518) (3.41297) (6.12401) (27.6299) (1.43805)
(8.30959) (1.01315)

[1.14365] [-0.13558] [-0.00087] [-0.02823] [-0.41984] [0.14638]
[-0.39344] [-0.19934]

D(LIWS(-1)) 0.119971 0.490099 0.018448 4.177649 -15.73859 -
0.597687 0.770667 -0.607940

(0.34333) (0.21374) (3.55526) (6.37934) (28.7818) (1.49800)
(8.65604) (1.05539)

[0.34943] [2.29301] [0.00519] [0.65487] [-0.54682] [-0.39899]
[0.08903] [-0.57604]

D(LIWS(-2)) 0.088294 0.063300 -1.040322 6.866291 -19.60961 -
0.413708 -0.500189 -0.959924

(0.34749) (0.21632) (3.59830) (6.45656) (29.1302) (1.51614)
(8.76082) (1.06816)

[0.25410] [0.29262] [-0.28911] [1.06346] [-0.67317] [-0.27287]
[-0.05709] [-0.89867]

D(LGDP(-1)) 0.006080 0.004781 0.597231 -0.023182 -0.080418 -
0.029799 0.202801 -0.005288

(0.01259) (0.00783) (0.13032) (0.23384) (1.05502) (0.05491)
(0.31729) (0.03869)

[0.48312] [0.61028] [4.58276] [-0.09914] [-0.07622] [-0.54267]
[0.63916] [-0.13669]

D(LGDP(-2)) -0.003935 -0.001471 0.143395 -0.019948 -0.670715
0.010162 0.007449 0.027601

(0.01259) (0.00784) (0.13041) (0.23400) (1.05577) (0.05495)
(0.31752) (0.03871)

[-0.31246] [-0.18757] [1.09955] [-0.08525] [-0.63529] [0.18493]
[0.02346] [0.71295]

D(LEDUA(-1)) 2.39E-05 0.000319 0.052144 0.422275 -0.072235
0.000407 0.086918 0.000412

(0.00794) (0.00494) (0.08222) (0.14753) (0.66564) (0.03464)
(0.20019) (0.02441)

[0.00301] [0.06462] [0.63418] [2.86221] [-0.10852] [0.01176]
[0.43418] [0.01689]

D(LEDUA(-2)) -0.004927 -0.004573 0.032540 0.106723 -0.316594
0.018874 -0.099873 0.005820

(0.00759) (0.00472) (0.07856) (0.14097) (0.63601) (0.03310)
(0.19128) (0.02332)

[-0.64949] [-0.96814] [0.41419] [0.75707] [-0.49778] [0.57017]
[-0.52214] [0.24955]

D(LPCHE(-1))	-0.001141	-0.000581	0.001673	-0.011429	0.543782	0.005082	-0.004020	0.000604
	(0.00153)	(0.00095)	(0.01581)	(0.02837)	(0.12799)	(0.00666)	(0.03849)	(0.00469)
	[-0.74719]	[-0.61140]	[0.10583]	[-0.40288]	[4.24873]	[0.76285]	[-0.10444]	[0.12869]
D(LPCHE(-2))	-0.001527	-0.000225	0.016936	-0.016811	0.091418	0.005767	-0.006245	0.001584
	(0.00156)	(0.00097)	(0.01617)	(0.02901)	(0.13088)	(0.00681)	(0.03936)	(0.00480)
	[-0.97788]	[-0.23154]	[1.04759]	[-0.57954]	[0.69851]	[0.84663]	[-0.15867]	[0.33007]
D(LTFR(-1))	-0.023745	-0.032854	-0.150501	0.284839	0.721974	0.679030	1.068578	-0.035723
	(0.09061)	(0.05641)	(0.93828)	(1.68359)	(7.59592)	(0.39534)	(2.28445)	(0.27853)
	[-0.26206]	[-0.58244]	[-0.16040]	[0.16919]	[0.09505]	[1.71757]	[0.46776]	[-0.12825]
D(LTFR(-2))	-0.003846	-0.047233	-0.025711	1.025440	-7.072345	0.406410	-1.574249	-0.137888
	(0.09157)	(0.05700)	(0.94821)	(1.70140)	(7.67626)	(0.39952)	(2.30861)	(0.28148)
	[-0.04200]	[-0.82858]	[-0.02712]	[0.60270]	[-0.92133]	[1.01723]	[-0.68190]	[-0.48987]

D(LUNOUR(-1))	-0.002057	-0.001667	0.022183	-0.044621	0.047721	0.016269	0.691714	-0.002712	
	(0.00734)	(0.00457)	(0.07602)	(0.13641)	(0.61546)	(0.03203)	(0.18510)	(0.02257)	
	[-0.28013]	[-0.36481]	[0.29179]	[-0.32710]	[0.07754]	[0.50788]	[3.73703]	[-0.12019]	
D(LUNOUR(-2))	-0.007381	-0.004923	0.006909	0.067150	-0.328994	0.035573	0.030081	-0.000158	
	(0.00771)	(0.00480)	(0.07988)	(0.14334)	(0.64671)	(0.03366)	(0.19450)	(0.02371)	
	[-0.95673]	[-1.02505]	[0.08649]	[0.46846]	[-0.50872]	[1.05685]	[0.15466]	[-0.00665]	
D(LURBAN(-1))	-0.003241	-0.005299	-0.285222	-0.057697	-0.175755	0.017182	0.000268	0.448629	
	(0.03942)	(0.02454)	(0.40821)	(0.73247)	(3.30472)	(0.17200)	(0.99388)	(0.12118)	
	[-0.08221]	[-0.21594]	[-0.69871]	[-0.07877]	[-0.05318]	[0.09990]	[0.00027]	[3.70221]	
D(LURBAN(-2))	-0.004426	0.001004	-0.286566	-0.414126	0.070145	0.015464	0.209273	0.052215	
	(0.03932)	(0.02448)	(0.40716)	(0.73058)	(3.29616)	(0.17155)	(0.99131)	(0.12087)	

[-0.11256] [0.04100] [-0.70382] [-0.56685] [0.02128] [0.09014]
[0.21111] [0.43201]

C -0.000274 0.000330 0.003371 -0.006861 0.038239 0.001712
-0.003886 0.002263

(0.00033) (0.00021) (0.00343) (0.00615) (0.02773) (0.00144)
(0.00834) (0.00102)

[-0.82881] [1.60361] [0.98398] [-1.11628] [1.37891] [1.18648]
[-0.46594] [2.22574]

R-squared 0.992178 0.858235 0.679699 0.354398 0.502244
0.882515 0.606403 0.277737

Adj. R-squared 0.990305 0.824291 0.603008 0.199817 0.383063
0.854385 0.512162 0.104801

Sum sq. resids 1.16E-05 4.48E-06 0.001240 0.003991 0.081245
0.000220 0.007349 0.000109

S.E. equation 0.000404 0.000251 0.004179 0.007498 0.033827
0.001761 0.010174 0.001240

F-statistic 529.7535 25.28408 8.862746 2.292638 4.214129
31.37248 6.434572 1.606007

Log likelihood 579.3305 621.5117 371.2935 319.2609 185.1664
448.2158 292.0988 479.3860

Akaike AIC -12.61417 -13.56206 -7.939179 -6.769908 -3.756548 -
9.667771 -6.159523 -10.36822

Schwarz SC -12.11085 -13.05874 -7.435859 -6.266588 -3.253228 -
9.164451 -5.656203 -9.864904

Mean dependent	7.33E-06	0.001188	0.007955	0.005016	0.006281
-0.001963	0.000908	0.001945			
S.D. dependent	0.004098	0.000599	0.006632	0.008382	0.043067
0.004614	0.014566	0.001311			

Determinant resid covariance (dof adj.) 5.13E-44

Determinant resid covariance 8.41E-45

Log likelihood 3505.886

Akaike information criterion -75.36823

Schwarz criterion -71.11797

Vector Error Correction Estimates
Date: 02/20/19 Time: 21:49
Sample (adjusted): 1994Q4 2016Q4
Included observations: 89 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LLIFE(-1)	1.000000
LIWS(-1)	2.704275 (2.77920) [0.97304]
LGDP(-1)	-0.144650 (0.17957) [-0.80552]
LEDUA(-1)	-0.176660 (0.15882) [-1.11230]
LPCHE(-1)	-0.056944 (0.03369) [-1.69032]
LTFR(-1)	-0.068826 (0.52220) [-0.13180]
LUNOUR(-1)	-0.123386

	(0.07894)
	[-1.56304]
LURBAN(-1)	-0.527168
	(1.33125)
	[-0.39600]
C	-11.36371

Error Correction:	D(LLIFE)	D(LIWS)	D(LGDP)	D(LEDUA)	D(LPCHE)	D(LTFR)
CointEq1	-0.006351	-0.001045	-0.014915	0.003709	-0.134203	0.002232
	(0.00176)	(0.00109)	(0.01818)	(0.03262)	(0.14717)	(0.00766)
	[-3.61781]	[-0.95654]	[-0.82044]	[0.11370]	[-0.91191]	[0.29142]
D(LLIFE(-1))	0.618389	0.027015	-0.180513	0.050093	11.47339	-0.247100
	(0.33152)	(0.20638)	(3.43293)	(6.15983)	(27.7915)	(1.44646)
	[1.86534]	[0.13090]	[-0.05258]	[0.00813]	[0.41284]	[-0.17083]
D(LLIFE(-2))	0.376933	-0.027818	-0.002974	-0.172894	-11.60016	0.210495
	(0.32959)	(0.20518)	(3.41297)	(6.12401)	(27.6299)	(1.43805)
	[1.14365]	[-0.13558]	[-0.00087]	[-0.02823]	[-0.41984]	[0.14638]
D(LIWS(-1))	0.119971	0.490099	0.018448	4.177649	-15.73859	-0.597687
	(0.34333)	(0.21374)	(3.55526)	(6.37934)	(28.7818)	(1.49800)
	[0.34943]	[2.29301]	[0.00519]	[0.65487]	[-0.54682]	[-0.39899]
D(LIWS(-2))	0.088294	0.063300	-1.040322	6.866291	-19.60961	-0.413708
	(0.34749)	(0.21632)	(3.59830)	(6.45656)	(29.1302)	(1.51614)
	[0.25410]	[0.29262]	[-0.28911]	[1.06346]	[-0.67317]	[-0.27287]
D(LGDP(-1))	0.006080	0.004781	0.597231	-0.023182	-0.080418	-0.029799
	(0.01259)	(0.00783)	(0.13032)	(0.23384)	(1.05502)	(0.05491)
	[0.48312]	[0.61028]	[4.58276]	[-0.09914]	[-0.07622]	[-0.54267]
D(LGDP(-2))	-0.003935	-0.001471	0.143395	-0.019948	-0.670715	0.010162
	(0.01259)	(0.00784)	(0.13041)	(0.23400)	(1.05577)	(0.05495)
	[-0.31246]	[-0.18757]	[1.09955]	[-0.08525]	[-0.63529]	[0.18493]
D(LEDUA(-1))	2.39E-05	0.000319	0.052144	0.422275	-0.072235	0.000407
	(0.00794)	(0.00494)	(0.08222)	(0.14753)	(0.66564)	(0.03464)
	[0.00301]	[0.06462]	[0.63418]	[2.86221]	[-0.10852]	[0.01176]
D(LEDUA(-2))	-0.004927	-0.004573	0.032540	0.106723	-0.316594	0.018874
	(0.00759)	(0.00472)	(0.07856)	(0.14097)	(0.63601)	(0.03310)
	[-0.64949]	[-0.96814]	[0.41419]	[0.75707]	[-0.49778]	[0.57017]
D(LPCHE(-1))	-0.001141	-0.000581	0.001673	-0.011429	0.543782	0.005082
	(0.00153)	(0.00095)	(0.01581)	(0.02837)	(0.12799)	(0.00666)
	[-0.74719]	[-0.61140]	[0.10583]	[-0.40288]	[4.24873]	[0.76285]
D(LPCHE(-2))	-0.001527	-0.000225	0.016936	-0.016811	0.091418	0.005767
	(0.00156)	(0.00097)	(0.01617)	(0.02901)	(0.13088)	(0.00681)
	[-0.97788]	[-0.23154]	[1.04759]	[-0.57954]	[0.69851]	[0.84663]
D(LTFR(-1))	-0.023745	-0.032854	-0.150501	0.284839	0.721974	0.679030
	(0.09061)	(0.05641)	(0.93828)	(1.68359)	(7.59592)	(0.39534)
	[-0.26206]	[-0.58244]	[-0.16040]	[0.16919]	[0.09505]	[1.71757]
D(LTFR(-2))	-0.003846	-0.047233	-0.025711	1.025440	-7.072345	0.406410
	(0.09157)	(0.05700)	(0.94821)	(1.70140)	(7.67626)	(0.39952)
	[-0.04200]	[-0.82858]	[-0.02712]	[0.60270]	[-0.92133]	[1.01723]

D(LUNOUR(-1))	-0.002057	-0.001667	0.022183	-0.044621	0.047721	0.016269
	(0.00734)	(0.00457)	(0.07602)	(0.13641)	(0.61546)	(0.03203)
	[-0.28013]	[-0.36481]	[0.29179]	[-0.32710]	[0.07754]	[0.50788]
D(LUNOUR(-2))	-0.007381	-0.004923	0.006909	0.067150	-0.328994	0.035573
	(0.00771)	(0.00480)	(0.07988)	(0.14334)	(0.64671)	(0.03366)
	[-0.95673]	[-1.02505]	[0.08649]	[0.46846]	[-0.50872]	[1.05685]
D(LURBAN(-1))	-0.003241	-0.005299	-0.285222	-0.057697	-0.175755	0.017182
	(0.03942)	(0.02454)	(0.40821)	(0.73247)	(3.30472)	(0.17200)
	[-0.08221]	[-0.21594]	[-0.69871]	[-0.07877]	[-0.05318]	[0.09990]
D(LURBAN(-2))	-0.004426	0.001004	-0.286566	-0.414126	0.070145	0.015464
	(0.03932)	(0.02448)	(0.40716)	(0.73058)	(3.29616)	(0.17155)
	[-0.11256]	[0.04100]	[-0.70382]	[-0.56685]	[0.02128]	[0.09014]
C	-0.000274	0.000330	0.003371	-0.006861	0.038239	0.001712
	(0.00033)	(0.00021)	(0.00343)	(0.00615)	(0.02773)	(0.00144)
	[-0.82881]	[1.60361]	[0.98398]	[-1.11628]	[1.37891]	[1.18648]
R-squared	0.992178	0.858235	0.679699	0.354398	0.502244	0.882515
Adj. R-squared	0.990305	0.824291	0.603008	0.199817	0.383063	0.854385
Sum sq. resids	1.16E-05	4.48E-06	0.001240	0.003991	0.081245	0.000220
S.E. equation	0.000404	0.000251	0.004179	0.007498	0.033827	0.001761
F-statistic	529.7535	25.28408	8.862746	2.292638	4.214129	31.37248
Log likelihood	579.3305	621.5117	371.2935	319.2609	185.1664	448.2158
Akaike AIC	-12.61417	-13.56206	-7.939179	-6.769908	-3.756548	-9.667771
Schwarz SC	-12.11085	-13.05874	-7.435859	-6.266588	-3.253228	-9.164451
Mean dependent	7.33E-06	0.001188	0.007955	0.005016	0.006281	-0.001963
S.D. dependent	0.004098	0.000599	0.006632	0.008382	0.043067	0.004614

Determinant resid covariance (dof adj.)	5.13E-44
Determinant resid covariance	8.41E-45
Log likelihood	3505.886
Akaike information criterion	-75.36823
Schwarz criterion	-71.11797

Autocorrelation M Test

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 02/20/19 Time: 21:50
Sample: 1994Q1 2016Q4
Included observations: 89

Lags	LM-Stat	Prob
1	21.57729	1.0000
2	86.84902	0.0303

Probs from chi-square with 64 df.

Normality Test

VEC Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 02/20/19 Time: 21:51
Sample: 1994Q1 2016Q4
Included observations: 89

Component	Skewness	Chi-sq	df	Prob.
1	2.334875	80.86601	1	0.0000
2	-0.600792	5.354109	1	0.0207
3	-2.476555	90.97765	1	0.0000
4	-0.216680	0.696428	1	0.4040
5	1.293727	24.82700	1	0.0000
6	0.370734	2.038750	1	0.1533
7	0.086427	0.110800	1	0.7392
8	-0.181646	0.489427	1	0.4842
Joint		205.3602	8	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	27.09317	2152.617	1	0.0000
2	6.145763	36.69702	1	0.0000
3	18.08363	843.7053	1	0.0000
4	11.98094	299.1043	1	0.0000
5	11.05972	240.8902	1	0.0000
6	5.374461	20.90782	1	0.0000
7	4.004794	3.743972	1	0.0530
8	14.72095	509.4530	1	0.0000
Joint		4107.119	8	0.0000

Component	Jarque-Bera	df	Prob.
1	2233.483	2	0.0000
2	42.05113	2	0.0000
3	934.6829	2	0.0000
4	299.8007	2	0.0000
5	265.7172	2	0.0000
6	22.94657	2	0.0000
7	3.854772	2	0.1455
8	509.9425	2	0.0000
Joint	4312.479	16	0.0000

White Heteroskedasicity (No cross terms)

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 02/20/19 Time: 21:51
Sample: 1994Q1 2016Q4
Included observations: 89

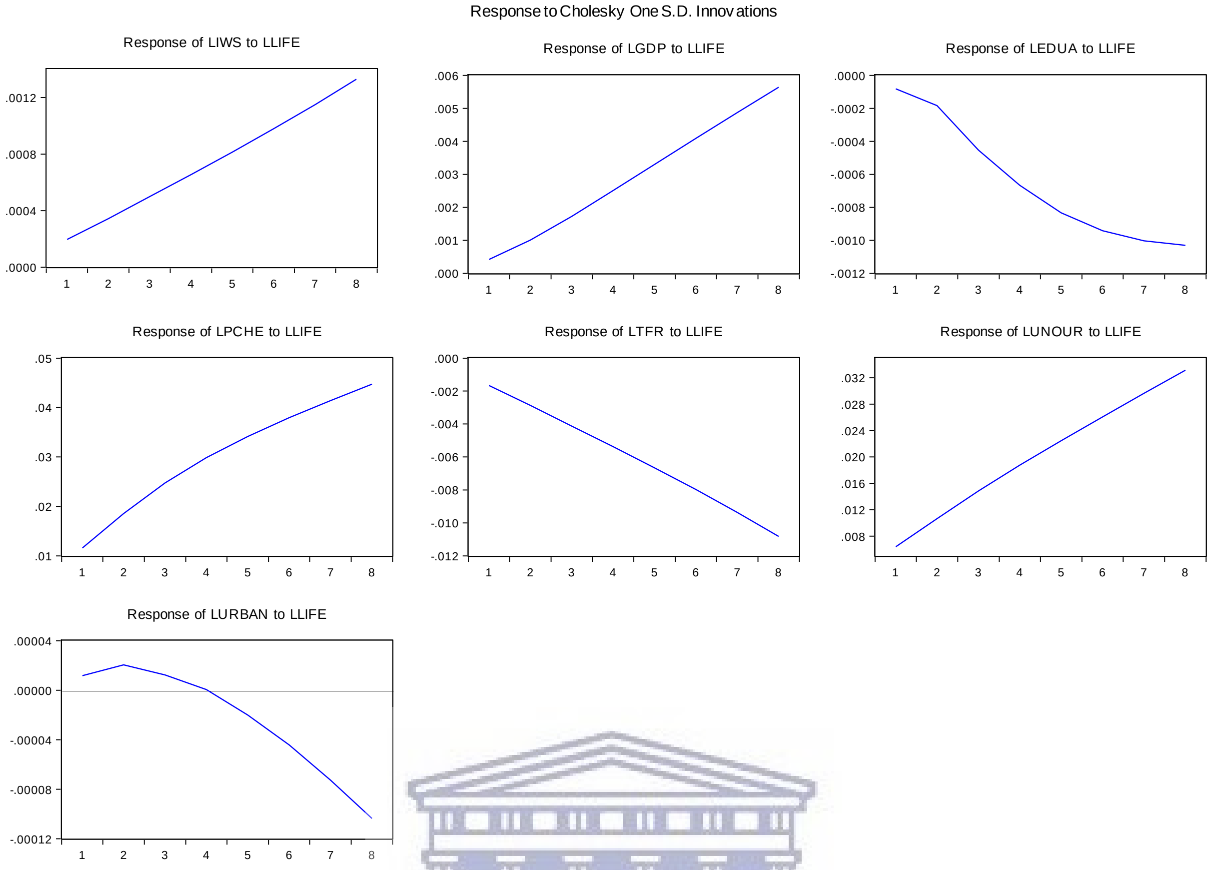
Joint test:

Chi-sq	df	Prob.
1247.585	1224	0.3131

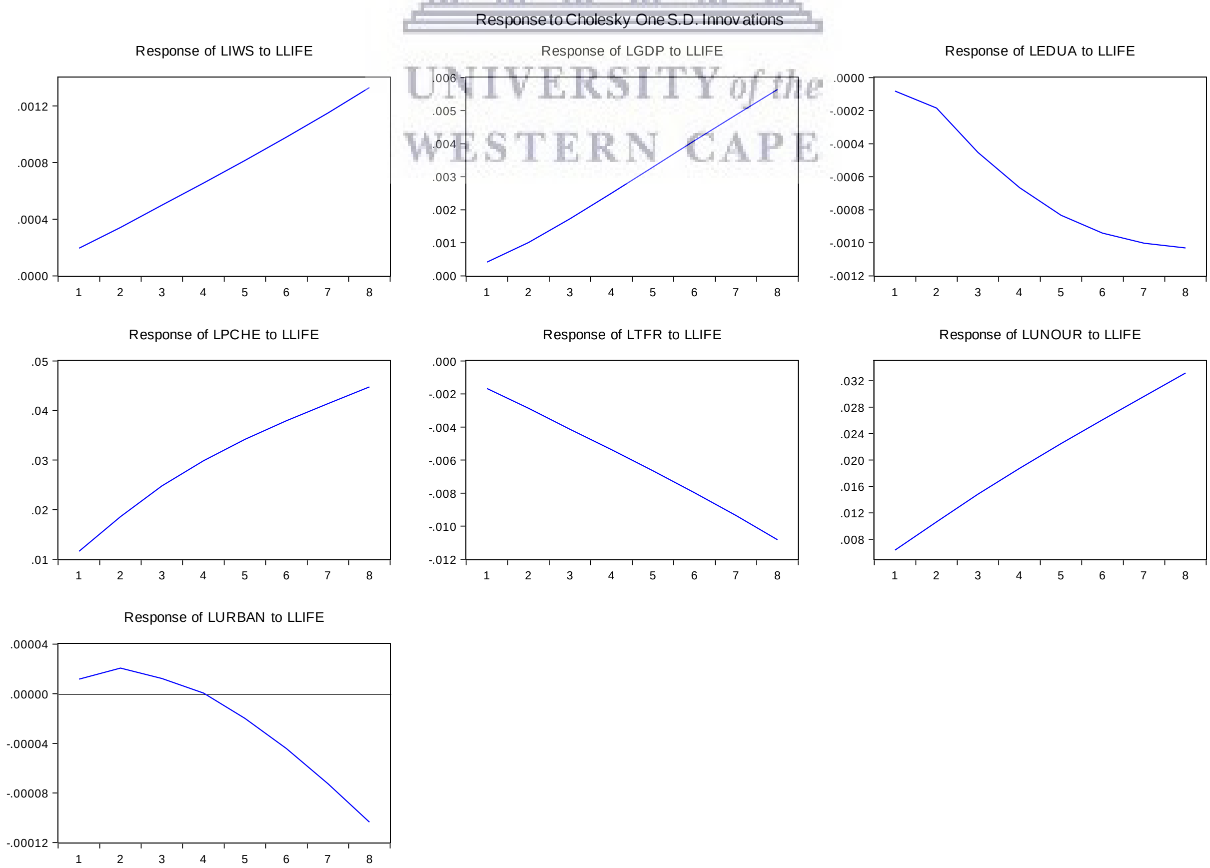
Individual components:

Dependent	R-squared	F(34,54)	Prob.	Chi-sq(34)	Prob.
res1*res1	0.547223	1.919527	0.0157	48.70282	0.0490
res2*res2	0.515616	1.690639	0.0414	45.88979	0.0837
res3*res3	0.286845	0.638819	0.9172	25.52919	0.8519
res4*res4	0.231194	0.477612	0.9882	20.57629	0.9661
res5*res5	0.320475	0.749038	0.8140	28.52229	0.7329
res6*res6	0.546281	1.912244	0.0162	48.61898	0.0498
res7*res7	0.460072	1.353333	0.1576	40.94639	0.1920
res8*res8	0.286103	0.636506	0.9188	25.46320	0.8542
res2*res1	0.556500	1.992907	0.0115	49.52854	0.0415
res3*res1	0.496406	1.565567	0.0692	44.18016	0.1135
res3*res2	0.369066	0.929042	0.5840	32.84689	0.5240
res4*res1	0.178638	0.345426	0.9993	15.89881	0.9965
res4*res2	0.229523	0.473130	0.9890	20.42752	0.9680
res4*res3	0.214665	0.434132	0.9945	19.10520	0.9814
res5*res1	0.487638	1.511594	0.0859	43.39976	0.1296
res5*res2	0.487112	1.508416	0.0870	43.35297	0.1306
res5*res3	0.156462	0.294591	0.9999	13.92512	0.9991
res5*res4	0.259596	0.556858	0.9644	23.10407	0.9212
res6*res1	0.548616	1.930355	0.0150	48.82682	0.0478
res6*res2	0.559911	2.020658	0.0102	49.83205	0.0391
res6*res3	0.841502	8.432322	0.0000	74.89370	0.0001
res6*res4	0.430409	1.200144	0.2699	38.30642	0.2803
res6*res5	0.512089	1.666938	0.0457	45.57591	0.0887
res7*res1	0.506540	1.630337	0.0532	45.08210	0.0969
res7*res2	0.541391	1.874923	0.0190	48.18381	0.0543
res7*res3	0.261013	0.560970	0.9626	23.23015	0.9183
res7*res4	0.225514	0.462459	0.9908	20.07070	0.9722
res7*res5	0.479357	1.462291	0.1042	42.66277	0.1464
res7*res6	0.516047	1.693558	0.0409	45.92814	0.0832
res8*res1	0.093670	0.164145	1.0000	8.336620	1.0000
res8*res2	0.177964	0.343841	0.9993	15.83884	0.9966
res8*res3	0.203780	0.406484	0.9969	18.13642	0.9881
res8*res4	0.233823	0.484701	0.9868	20.81028	0.9631
res8*res5	0.235310	0.488732	0.9859	20.94262	0.9612
res8*res6	0.199799	0.396559	0.9975	17.78207	0.9900
res8*res7	0.222638	0.454874	0.9919	19.81479	0.9749

Impulse response 10



Impulse response 8



VAR

Vector Autoregression Estimates
Date: 02/20/19 Time: 21:59
Sample (adjusted): 1994Q3 2016Q4
Included observations: 90 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LLIFE	LIWS	LGDP	LEDUA	LPCHE	LTFR
LLIFE(-1)	2.095270	0.076127	0.816136	-0.921035	11.76141	-0.624133
	(0.08231)	(0.05023)	(0.80415)	(1.44012)	(6.87483)	(0.34747)
	[25.4555]	[1.51556]	[1.01490]	[-0.63955]	[1.71079]	[-1.79624]
LLIFE(-2)	-1.096771	-0.075651	-0.871898	0.770247	-11.66175	0.610526
	(0.08090)	(0.04937)	(0.79037)	(1.41545)	(6.75703)	(0.34151)
	[-13.5570]	[-1.53233]	[-1.10315]	[0.54417]	[-1.72587]	[1.78771]
LIWS(-1)	0.080241	1.406025	-0.401960	4.900667	-3.830602	-0.443077
	(0.31062)	(0.18956)	(3.03470)	(5.43472)	(25.9441)	(1.31126)
	[0.25832]	[7.41731]	[-0.13245]	[0.90173]	[-0.14765]	[-0.33790]
LIWS(-2)	-0.148356	-0.448076	1.099292	-0.899914	0.338846	0.740494
	(0.31733)	(0.19365)	(3.10019)	(5.55200)	(26.5040)	(1.33956)
	[-0.46752]	[-2.31384]	[0.35459]	[-0.16209]	[0.01278]	[0.55279]
LGDP(-1)	0.012998	0.010683	1.483210	-0.047483	0.022559	-0.067143
	(0.01051)	(0.00641)	(0.10269)	(0.18390)	(0.87791)	(0.04437)
	[1.23665]	[1.66546]	[14.4437]	[-0.25820]	[0.02570]	[-1.51322]
LGDP(-2)	-0.008794	-0.009351	-0.575244	-0.035971	-0.108051	0.052149
	(0.01017)	(0.00621)	(0.09941)	(0.17802)	(0.84983)	(0.04295)
	[-0.86428]	[-1.50590]	[-5.78684]	[-0.20206]	[-0.12714]	[1.21412]
LEDUA(-1)	0.005823	0.003015	0.072313	1.183708	-0.196329	-0.028343
	(0.00707)	(0.00432)	(0.06911)	(0.12377)	(0.59086)	(0.02986)
	[0.82309]	[0.69830]	[1.04629]	[9.56359]	[-0.33228]	[-0.94911]
LEDUA(-2)	-0.006845	-0.004681	-0.015784	-0.351095	0.427363	0.034766
	(0.00663)	(0.00405)	(0.06477)	(0.11599)	(0.55372)	(0.02799)
	[-1.03256]	[-1.15694]	[-0.24370]	[-3.02686]	[0.77180]	[1.24225]
LPCHE(-1)	-0.000786	-1.85E-05	-0.001634	-0.015803	1.527361	0.004358
	(0.00121)	(0.00074)	(0.01183)	(0.02119)	(0.10113)	(0.00511)
	[-0.64920]	[-0.02501]	[-0.13815]	[-0.74596]	[15.1024]	[0.85251]
LPCHE(-2)	-0.000161	-0.000606	0.014380	0.006802	-0.637340	0.001388
	(0.00132)	(0.00081)	(0.01292)	(0.02313)	(0.11042)	(0.00558)
	[-0.12207]	[-0.75139]	[1.11344]	[0.29410]	[-5.77219]	[0.24881]
LTFR(-1)	0.109804	-0.003765	0.264133	-0.869014	3.816789	1.409247
	(0.06236)	(0.03805)	(0.60922)	(1.09104)	(5.20836)	(0.26324)
	[1.76084]	[-0.09894]	[0.43356]	[-0.79650]	[0.73282]	[5.35348]
LTFR(-2)	-0.129290	-0.009769	-0.216945	1.666160	-4.610906	-0.307290
	(0.07201)	(0.04395)	(0.70355)	(1.25997)	(6.01480)	(0.30400)
	[-1.79535]	[-0.22229]	[-0.30836]	[1.32238]	[-0.76659]	[-1.01083]
LUNOUR(-1)	0.002937	0.001382	0.103457	-0.168973	0.404108	-0.010973
	(0.00579)	(0.00354)	(0.05660)	(0.10136)	(0.48388)	(0.02446)

	[0.50699]	[0.39103]	[1.82787]	[-1.66702]	[0.83514]	[-0.44868]
LUNOUR(-2)	-0.006898	-0.003965	-0.093399	0.193003	-0.469227	0.031575
	(0.00623)	(0.00380)	(0.06087)	(0.10901)	(0.52040)	(0.02630)
	[-1.10716]	[-1.04288]	[-1.53434]	[1.77045]	[-0.90166]	[1.20048]
LURBAN(-1)	-0.004198	0.004840	-0.234144	-0.026856	0.123896	0.025712
	(0.03440)	(0.02099)	(0.33604)	(0.60180)	(2.87287)	(0.14520)
	[-0.12205]	[0.23059]	[-0.69677]	[-0.04463]	[0.04313]	[0.17708]
LURBAN(-2)	-0.000749	-0.002267	-0.046662	-0.524452	0.587599	0.003847
	(0.03534)	(0.02157)	(0.34530)	(0.61839)	(2.95204)	(0.14920)
	[-0.02120]	[-0.10511]	[-0.13513]	[-0.84810]	[0.19905]	[0.02578]
C	0.328417	0.192437	-1.276857	-14.39845	13.73000	-1.455155
	(0.22816)	(0.13924)	(2.22907)	(3.99194)	(19.0566)	(0.96316)
	[1.43941]	[1.38209]	[-0.57282]	[-3.60688]	[0.72048]	[-1.51082]
R-squared	0.999965	0.999962	0.999818	0.998341	0.994531	0.999532
Adj. R-squared	0.999958	0.999954	0.999778	0.997977	0.993332	0.999430
Sum sq. resids	1.02E-05	3.81E-06	0.000976	0.003129	0.071308	0.000182
S.E. equation	0.000374	0.000228	0.003656	0.006547	0.031254	0.001580
F-statistic	131579.7	120191.8	25014.37	2745.538	829.6971	9747.461
Log likelihood	591.8811	636.3302	386.7455	334.3029	193.6205	462.2665
Akaike AIC	-12.77514	-13.76289	-8.216567	-7.051175	-3.924901	-9.894811
Schwarz SC	-12.30295	-13.29071	-7.744381	-6.578989	-3.452715	-9.422624
Mean dependent	4.042187	4.486422	9.178872	4.167278	5.982614	1.000681
S.D. dependent	0.057553	0.033568	0.245179	0.145574	0.382757	0.066141

Determinant resid covariance (dof adj.)	1.35E-44
Determinant resid covariance	2.54E-45
Log likelihood	3599.225
Akaike information criterion	-76.96057
Schwarz criterion	-73.18308

Autocorrelation LM Test

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 02/20/19 Time: 22:00
Sample: 1994Q1 2016Q4
Included observations: 90

Lags	LM-Stat	Prob
1	51.06519	0.8792
2	4.768483	1.0000

Probs from chi-square with 64 df.

Normality

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 02/20/19 Time: 22:01

Sample: 1994Q1 2016Q4
Included observations: 90

Component	Skewness	Chi-sq	df	Prob.
1	3.187984	152.4486	1	0.0000
2	-0.562711	4.749648	1	0.0293
3	-2.476213	91.97447	1	0.0000
4	-0.338537	1.719108	1	0.1898
5	-0.163227	0.399646	1	0.5273
6	0.065855	0.065054	1	0.7987
7	0.044299	0.029436	1	0.8638
8	-0.805629	9.735564	1	0.0018
Joint		261.1215	8	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	30.65236	2867.449	1	0.0000
2	6.467748	45.09480	1	0.0000
3	18.76323	931.7974	1	0.0000
4	10.01786	184.6891	1	0.0000
5	9.899390	178.5059	1	0.0000
6	5.262250	19.19166	1	0.0000
7	4.922647	13.86214	1	0.0002
8	12.27846	322.8370	1	0.0000
Joint		4563.427	8	0.0000

Component	Jarque-Bera	df	Prob.
1	3019.898	2	0.0000
2	49.84444	2	0.0000
3	1023.772	2	0.0000
4	186.4082	2	0.0000
5	178.9056	2	0.0000
6	19.25672	2	0.0001
7	13.89157	2	0.0010
8	332.5726	2	0.0000
Joint	4824.549	16	0.0000

White Heerere

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 02/20/19 Time: 22:01
Sample: 1994Q1 2016Q4
Included observations: 90

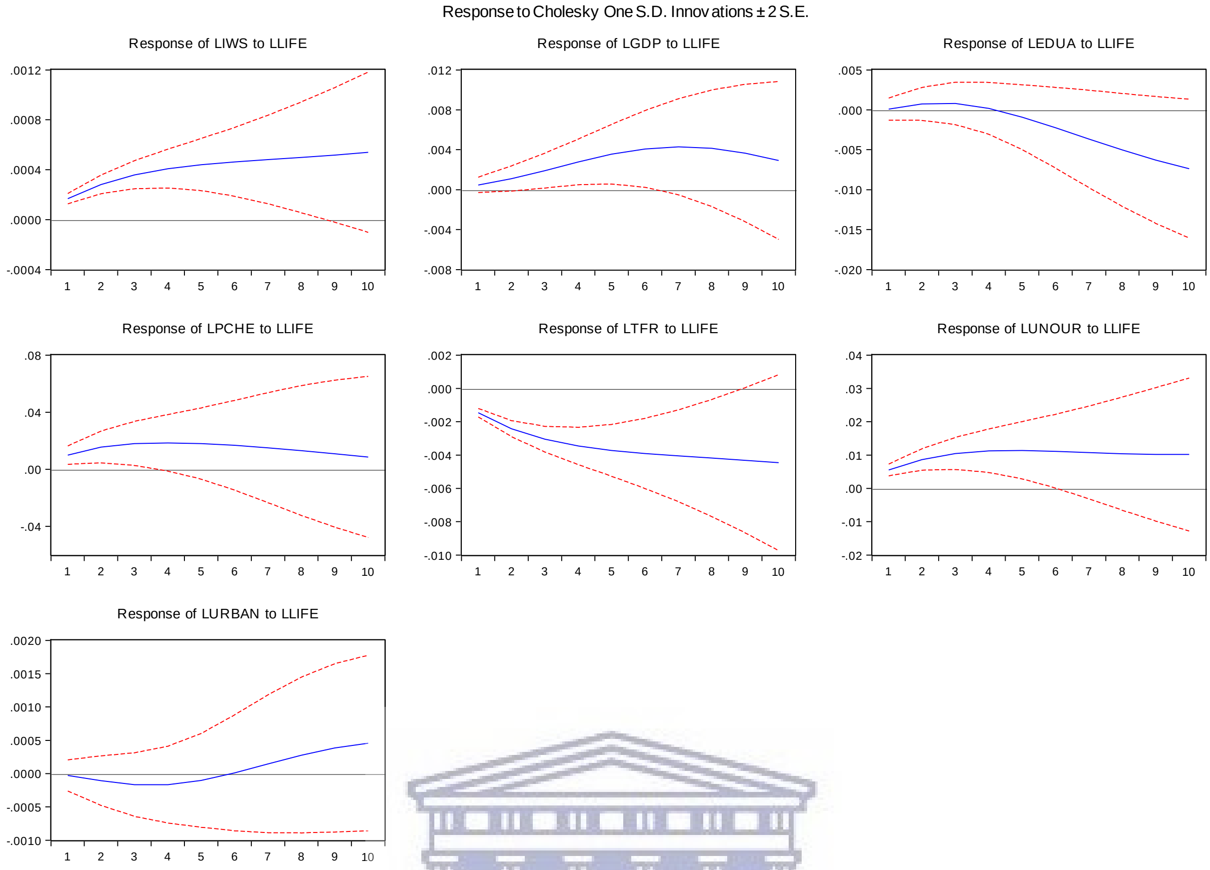
Joint test:

Chi-sq	df	Prob.
1367.369	1116	0.0000

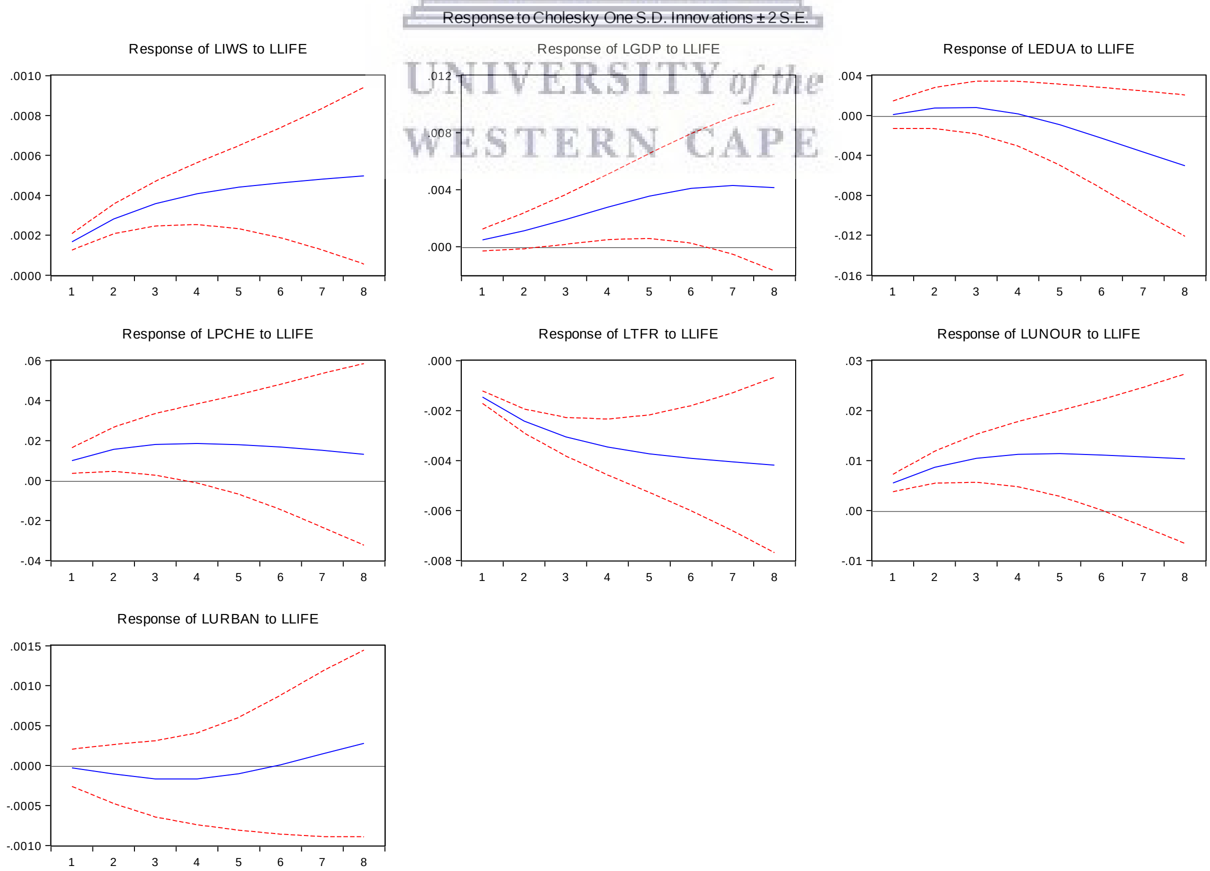
Individual components:

Dependent	R-squared	F(31,58)	Prob.	Chi-sq(31)	Prob.
res1*res1	0.378753	1.140667	0.3262	34.08780	0.3213
res2*res2	0.339996	0.963816	0.5336	30.59966	0.4865
res3*res3	0.288434	0.758397	0.7964	25.95903	0.7233
res4*res4	0.211709	0.502481	0.9800	19.05384	0.9540
res5*res5	0.301934	0.809248	0.7354	27.17404	0.6634
res6*res6	0.361371	1.058695	0.4158	32.52338	0.3917
res7*res7	0.313086	0.852763	0.6798	28.17777	0.6120
res8*res8	0.234599	0.573459	0.9523	21.11388	0.9089
res2*res1	0.379457	1.144082	0.3228	34.15114	0.3186
res3*res1	0.496453	1.844609	0.0221	44.68077	0.0532
res3*res2	0.331192	0.926497	0.5825	29.80725	0.5273
res4*res1	0.413250	1.317730	0.1802	37.19251	0.2053
res4*res2	0.336334	0.948173	0.5540	30.27007	0.5034
res4*res3	0.280190	0.728283	0.8295	25.21707	0.7579
res5*res1	0.331624	0.928306	0.5801	29.84614	0.5253
res5*res2	0.299336	0.799308	0.7477	26.94020	0.6752
res5*res3	0.359886	1.051899	0.4238	32.38974	0.3980
res5*res4	0.324812	0.900063	0.6175	29.23306	0.5571
res6*res1	0.372215	1.109300	0.3589	33.49934	0.3470
res6*res2	0.365762	1.078978	0.3924	32.91857	0.3733
res6*res3	0.644585	3.393206	0.0000	58.01263	0.0023
res6*res4	0.505643	1.913683	0.0164	45.50789	0.0449
res6*res5	0.321508	0.886570	0.6354	28.93570	0.5726
res7*res1	0.349174	1.003793	0.4825	31.42569	0.4449
res7*res2	0.358805	1.046972	0.4296	32.29247	0.4027
res7*res3	0.382293	1.157926	0.3091	34.40641	0.3079
res7*res4	0.278230	0.721224	0.8369	25.04066	0.7659
res7*res5	0.327302	0.910323	0.6039	29.45721	0.5454
res7*res6	0.348615	1.001324	0.4856	31.37536	0.4474
res8*res1	0.381655	1.154800	0.3121	34.34897	0.3103
res8*res2	0.280197	0.728310	0.8295	25.21773	0.7579
res8*res3	0.264222	0.671876	0.8842	23.78000	0.8194
res8*res4	0.304397	0.818740	0.7235	27.39576	0.6522
res8*res5	0.260912	0.660488	0.8940	23.48211	0.8311
res8*res6	0.317540	0.870539	0.6565	28.57864	0.5912
res8*res7	0.313936	0.856136	0.6754	28.25424	0.6080

Impulse 10


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of LIWS to LLIFE
Response of LGDP to LLIFE
Response of LEDUA to LLIFE
Response of LPCHE to LLIFE
Response of LTFR to LLIFE
Response of LUNOUR to LLIFE
Response of LURBAN to LLIFE

Impulse 8


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of LIWS to LLIFE
Response of LGDP to LLIFE
Response of LEDUA to LLIFE
Response of LPCHE to LLIFE
Response of LTFR to LLIFE
Response of LUNOUR to LLIFE
Response of LURBAN to LLIFE

Differenced Variables'

VECM

Vector Error Correction Estimates
Date: 02/20/19 Time: 22:16
Sample (adjusted): 1995Q1 2016Q4
Included observations: 88 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LLIFE(-1)	1.000000
D(LIWS(-1))	5.014714
	(23.4349)
	[0.21398]
D(LGDP(-1))	-0.099747
	(0.59862)
	[-0.16663]
D(LEDUA(-1))	0.715553
	(0.46251)
	[1.54712]
LPCHE(-1)	-0.076027
	(0.03276)
	[-2.32088]
D(LTFR(-1))	4.401186
	(3.31260)
	[1.32862]
LUNOUR(-1)	-0.173854
	(0.06964)
	[-2.49632]
D(LURBAN(-1))	-1.266193
	(2.71495)
	[-0.46638]
C	-3.332025

Error Correction:	D(LLIFE)	D(LIWS,2)	D(LGDP,2)	D(LEDUA,2)	D(LPCHE)	D(LTFR,2)
CointEq1	-0.006195	-0.000588	0.010630	-0.039538	-0.012374	0.003417
	(0.00165)	(0.00105)	(0.01747)	(0.03214)	(0.13503)	(0.00721)
	[-3.74490]	[-0.56268]	[0.60860]	[-1.23004]	[-0.09164]	[0.47388]
D(LLIFE(-1))	0.672383	-0.001560	0.841911	-4.496396	13.90288	-0.243322
	(0.34622)	(0.21877)	(3.65582)	(6.72776)	(28.2626)	(1.50911)
	[1.94206]	[-0.00713]	[0.23029]	[-0.66833]	[0.49192]	[-0.16123]
D(LLIFE(-2))	0.302788	-0.003741	-0.910131	4.419462	-13.82917	0.264314
	(0.34227)	(0.21627)	(3.61414)	(6.65106)	(27.9404)	(1.49191)
	[0.88464]	[-0.01730]	[-0.25182]	[0.66447]	[-0.49495]	[0.17716]
D(LIWS(-1),2)	0.041263	-0.279794	-0.538617	1.590443	4.833977	-0.335916

	(0.33018)	(0.20863)	(3.48644)	(6.41606)	(26.9532)	(1.43919)
	[0.12497]	[-1.34109]	[-0.15449]	[0.24788]	[0.17935]	[-0.23341]
D(LIWS(-2),2)	0.038987	-0.046649	-0.866922	1.946736	5.133092	-0.326311
	(0.32763)	(0.20702)	(3.45955)	(6.36657)	(26.7453)	(1.42809)
	[0.11900]	[-0.22533]	[-0.25059]	[0.30577]	[0.19193]	[-0.22849]
D(LGDP(-1),2)	0.003189	0.002392	-0.265681	0.046313	0.217030	-0.019565
	(0.01267)	(0.00801)	(0.13379)	(0.24621)	(1.03431)	(0.05523)
	[0.25171]	[0.29875]	[-1.98580]	[0.18810]	[0.20983]	[-0.35426]
D(LGDP(-2),2)	0.001938	0.001822	-0.029669	0.040251	0.126702	-0.015237
	(0.01218)	(0.00770)	(0.12860)	(0.23666)	(0.99419)	(0.05309)
	[0.15910]	[0.23674]	[-0.23071]	[0.17008]	[0.12744]	[-0.28703]
D(LEDUA(-1),2)	0.002550	0.000874	0.011835	-0.281551	-0.019943	-0.006126
	(0.00762)	(0.00481)	(0.08041)	(0.14798)	(0.62165)	(0.03319)
	[0.33489]	[0.18170]	[0.14718]	[-1.90262]	[-0.03208]	[-0.18456]
D(LEDUA(-2),2)	0.000159	-0.000138	0.008531	-0.047062	-0.074944	-0.000125
	(0.00643)	(0.00406)	(0.06790)	(0.12496)	(0.52496)	(0.02803)
	[0.02477]	[-0.03401]	[0.12564]	[-0.37660]	[-0.14276]	[-0.00445]
D(LPCHE(-1))	-0.001202	-0.000459	0.007505	-0.017334	0.575868	0.005716
	(0.00161)	(0.00102)	(0.01697)	(0.03124)	(0.13122)	(0.00701)
	[-0.74758]	[-0.45189]	[0.44217]	[-0.55493]	[4.38869]	[0.81576]
D(LPCHE(-2))	-0.001178	-0.000287	0.012203	-0.007368	0.076484	0.003293
	(0.00165)	(0.00104)	(0.01740)	(0.03203)	(0.13454)	(0.00718)
	[-0.71493]	[-0.27574]	[0.70119]	[-0.23006]	[0.56848]	[0.45835]
D(LTFR(-1),2)	-0.028972	-0.020474	0.034517	-0.646067	3.393360	-0.186225
	(0.09035)	(0.05709)	(0.95403)	(1.75570)	(7.37549)	(0.39382)
	[-0.32066]	[-0.35862]	[0.03618]	[-0.36798]	[0.46009]	[-0.47287]
D(LTFR(-2),2)	-0.035100	-0.029078	-0.140882	0.376646	-0.993320	0.162775
	(0.04541)	(0.02869)	(0.47952)	(0.88245)	(3.70710)	(0.19794)
	[-0.77291]	[-1.01334]	[-0.29380]	[0.42682]	[-0.26795]	[0.82232]
D(LUNOUR(-1))	-0.005499	-0.002113	0.005729	0.051027	0.010908	0.020144
	(0.00766)	(0.00484)	(0.08086)	(0.14881)	(0.62512)	(0.03338)
	[-0.71814]	[-0.43662]	[0.07085]	[0.34291]	[0.01745]	[0.60349]
D(LUNOUR(-2))	-0.005391	-0.002644	-0.004484	0.036731	-0.212656	0.021034
	(0.00809)	(0.00511)	(0.08542)	(0.15720)	(0.66039)	(0.03526)
	[-0.66633]	[-0.51726]	[-0.05249]	[0.23365]	[-0.32202]	[0.59651]
D(LURBAN(-1),2)	-0.008931	-0.001610	-0.050741	-0.038391	-0.219157	0.017260
	(0.03764)	(0.02378)	(0.39743)	(0.73138)	(3.07245)	(0.16406)
	[-0.23728]	[-0.06770]	[-0.12767]	[-0.05249]	[-0.07133]	[0.10521]
D(LURBAN(-2),2)	-0.005832	-0.000568	-0.086217	-0.031690	-0.014795	0.014299
	(0.03743)	(0.02365)	(0.39522)	(0.72732)	(3.05541)	(0.16315)
	[-0.15582]	[-0.02402]	[-0.21815]	[-0.04357]	[-0.00484]	[0.08764]
C	4.69E-05	-2.74E-05	-0.000298	9.91E-05	0.001487	0.000178
	(5.4E-05)	(3.4E-05)	(0.00057)	(0.00105)	(0.00440)	(0.00023)
	[0.87047]	[-0.80474]	[-0.52447]	[0.09466]	[0.33823]	[0.75736]
R-squared	0.991214	0.134436	0.093088	0.132008	0.471244	0.161348
Adj. R-squared	0.989081	-0.075772	-0.127162	-0.078790	0.342832	-0.042324
Sum sq. resids	1.30E-05	5.17E-06	0.001444	0.004890	0.086299	0.000246

S.E. equation	0.000430	0.000272	0.004542	0.008358	0.035112	0.001875
F-statistic	464.5559	0.639539	0.422645	0.626228	3.669780	0.792195
Log likelihood	567.3285	607.7265	359.9128	306.2396	179.9334	437.7750
Akaike AIC	-12.48474	-13.40287	-7.770745	-6.550900	-3.680305	-9.540341
Schwarz SC	-11.97801	-12.89615	-7.264017	-6.044172	-3.173577	-9.033613
Mean dependent	2.96E-05	-4.11E-05	-0.000102	-0.000137	0.006319	0.000316
S.D. dependent	0.004116	0.000262	0.004278	0.008047	0.043313	0.001836

Determinant resid covariance (dof adj.)	1.81E-43
Determinant resid covariance	2.90E-44
Log likelihood	3411.955
Akaike information criterion	-74.08989
Schwarz criterion	-69.81085

Auto

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 02/20/19 Time: 22:17
Sample: 1994Q1 2016Q4
Included observations: 88

Lags	LM-Stat	Prob
1	28.42279	1.0000
2	36.28458	0.9980

Probs from chi-square with 64 df.

Normality

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 02/20/19 Time: 22:18
Sample: 1994Q1 2016Q4
Included observations: 88

Component	Skewness	Chi-sq	df	Prob.
1	1.105798	17.93425	1	0.0000
2	-0.241819	0.857656	1	0.3544
3	-0.846309	10.50484	1	0.0012
4	-0.020688	0.006277	1	0.9369
5	1.351028	26.77074	1	0.0000
6	0.028556	0.011960	1	0.9129
7	0.177905	0.464203	1	0.4957
8	0.309355	1.403609	1	0.2361
Joint		57.95354	8	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	22.60387	1409.143	1	0.0000

2	3.746482	2.043197	1	0.1529
3	10.96293	232.4970	1	0.0000
4	6.336219	40.81130	1	0.0000
5	10.19986	190.0724	1	0.0000
6	3.946370	3.283926	1	0.0700
7	3.580565	1.235870	1	0.2663
8	7.820158	85.19104	1	0.0000
Joint		1964.278	8	0.0000

Component	Jarque-Bera	df	Prob.
1	1427.078	2	0.0000
2	2.900853	2	0.2345
3	243.0019	2	0.0000
4	40.81758	2	0.0000
5	216.8432	2	0.0000
6	3.295886	2	0.1924
7	1.700073	2	0.4274
8	86.59465	2	0.0000
Joint	2022.232	16	0.0000

White

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 02/20/19 Time: 22:18
Sample: 1994Q1 2016Q4
Included observations: 88

Joint test:

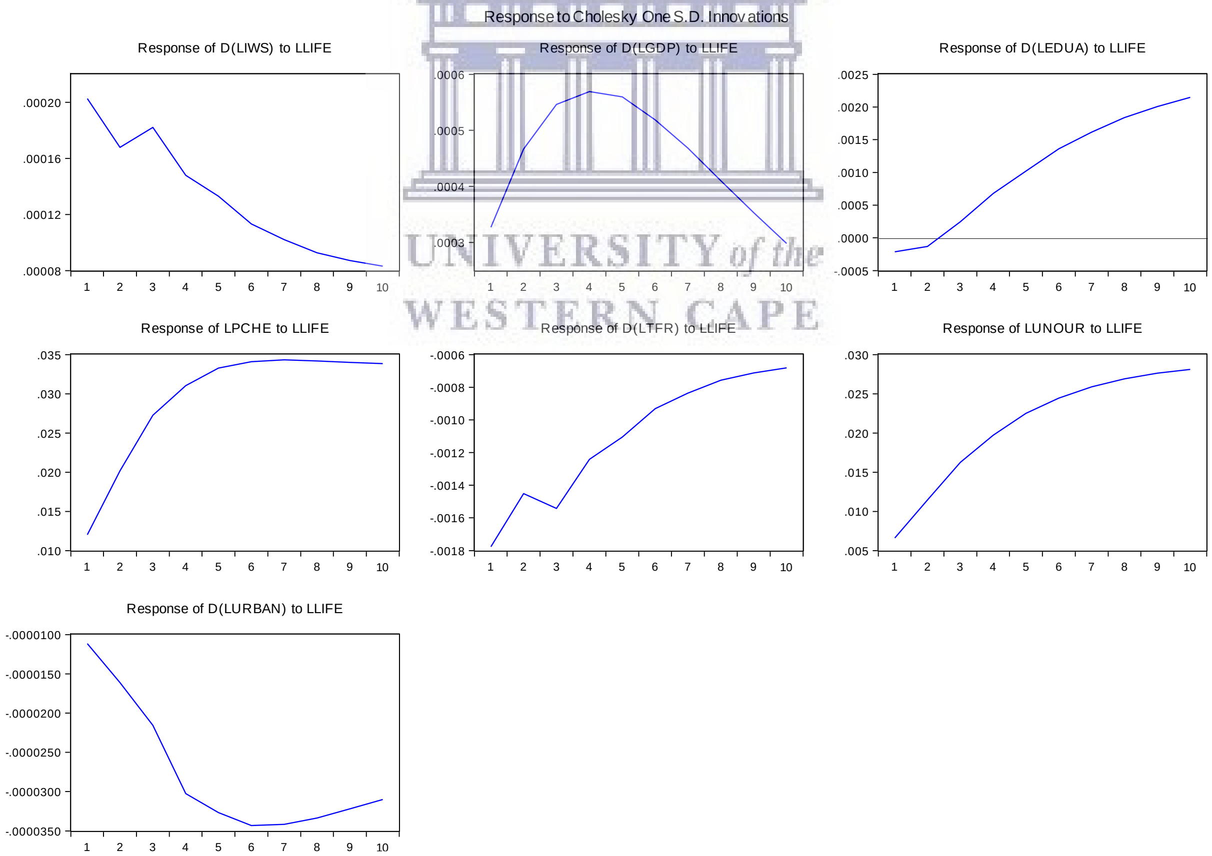
Chi-sq	df	Prob.
1165.076	1224	0.8844

Individual components:

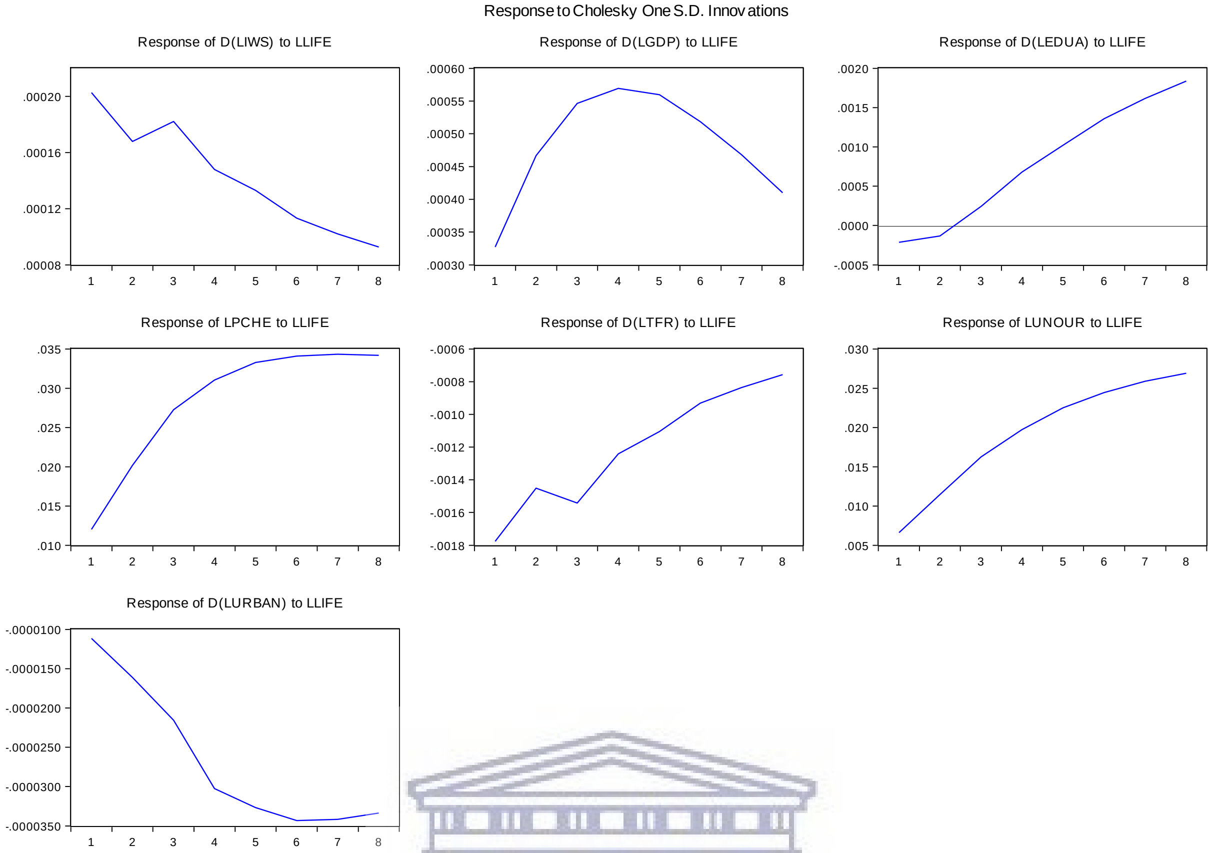
Dependent	R-squared	F(34,53)	Prob.	Chi-sq(34)	Prob.
res1*res1	0.599390	2.332299	0.0027	52.74630	0.0211
res2*res2	0.552290	1.922946	0.0159	48.60150	0.0500
res3*res3	0.382812	0.966864	0.5339	33.68748	0.4828
res4*res4	0.394626	1.016154	0.4705	34.72713	0.4331
res5*res5	0.325459	0.752116	0.8100	28.64040	0.7276
res6*res6	0.600047	2.338693	0.0027	52.80414	0.0209
res7*res7	0.436121	1.205643	0.2661	38.37868	0.2776
res8*res8	0.351926	0.846495	0.6939	30.96952	0.6169
res2*res1	0.595414	2.294062	0.0032	52.39643	0.0228
res3*res1	0.468179	1.372279	0.1480	41.19971	0.1847
res3*res2	0.368976	0.911483	0.6075	32.46986	0.5427
res4*res1	0.293337	0.647072	0.9104	25.81369	0.8421
res4*res2	0.367502	0.905727	0.6152	32.34018	0.5491
res4*res3	0.264364	0.560193	0.9626	23.26407	0.9175
res5*res1	0.493818	1.520747	0.0838	43.45597	0.1284

res5*res2	0.476641	1.419672	0.1240	41.94438	0.1644
res5*res3	0.195281	0.378280	0.9983	17.18475	0.9927
res5*res4	0.307836	0.693278	0.8710	27.08957	0.7940
res6*res1	0.602181	2.359598	0.0024	52.99190	0.0200
res6*res2	0.600270	2.340866	0.0026	52.82374	0.0208
res6*res3	0.838903	8.117478	0.0000	73.82346	0.0001
res6*res4	0.531063	1.765340	0.0310	46.73354	0.0716
res6*res5	0.499877	1.558058	0.0723	43.98919	0.1173
res7*res1	0.534099	1.787006	0.0283	47.00075	0.0681
res7*res2	0.546884	1.881404	0.0190	48.12576	0.0549
res7*res3	0.214233	0.425000	0.9953	18.85250	0.9834
res7*res4	0.349133	0.836173	0.7074	30.72373	0.6290
res7*res5	0.430346	1.177617	0.2916	37.87047	0.2971
res7*res6	0.540026	1.830114	0.0236	47.52228	0.0617
res8*res1	0.191702	0.369701	0.9986	16.86974	0.9938
res8*res2	0.287138	0.627889	0.9244	25.26817	0.8607
res8*res3	0.340949	0.806433	0.7453	30.00355	0.6640
res8*res4	0.332717	0.777251	0.7809	29.27907	0.6983
res8*res5	0.273592	0.587111	0.9495	24.07611	0.8966
res8*res6	0.283423	0.616552	0.9320	24.94124	0.8712
res8*res7	0.285246	0.622101	0.9284	25.10168	0.8661

Impulse 10



Impulse 8



VAR

Vector Autoregression Estimates
Date: 02/20/19 Time: 22:32
Sample (adjusted): 1995Q1 2016Q4
Included observations: 88 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LLIFE	D(LIWS,2)	D(LGDP,2)	D(LEDUA,2)	D(LPCHE)	D(LTFR,2)
LLIFE(-1)	1.969487	-0.018080	-0.168353	0.100385	-0.235222	0.133189
	(0.01324)	(0.00855)	(0.15111)	(0.28039)	(1.16137)	(0.05715)
	[148.779]	[-2.11535]	[-1.11409]	[0.35801]	[-0.20254]	[2.33039]
LLIFE(-2)	-0.976077	0.016579	0.168391	-0.113799	0.112267	-0.120992
	(0.01307)	(0.00844)	(0.14915)	(0.27675)	(1.14626)	(0.05641)
	[-74.7071]	[1.96526]	[1.12904]	[-0.41120]	[0.09794]	[-2.14490]
D(LIWS(-1),2)	0.027112	-0.293766	-0.659153	1.729116	4.351651	-0.211564
	(0.30282)	(0.19552)	(3.45680)	(6.41419)	(26.5672)	(1.30741)
	[0.08953]	[-1.50248]	[-0.19068]	[0.26958]	[0.16380]	[-0.16182]
D(LIWS(-2),2)	0.041501	-0.050472	-0.917006	2.068212	4.782914	-0.288503
	(0.30055)	(0.19405)	(3.43087)	(6.36608)	(26.3679)	(1.29761)
	[0.13808]	[-0.26009]	[-0.26728]	[0.32488]	[0.18139]	[-0.22233]
D(LGDP(-1),2)	-0.000143	0.000544	-0.269346	0.060795	0.144130	-0.004754
	(0.01119)	(0.00723)	(0.12778)	(0.23710)	(0.98204)	(0.04833)
	[-0.01276]	[0.07526]	[-2.10791]	[0.25641]	[0.14677]	[-0.09836]

D(LGDP(-2),2)	0.000752	0.000903	-0.033489	0.044950	0.112275	-0.007342
	(0.01119)	(0.00722)	(0.12769)	(0.23693)	(0.98134)	(0.04829)
	[0.06725]	[0.12503]	[-0.26227]	[0.18972]	[0.11441]	[-0.15203]
D(LEDUA(-1),2)	8.74E-05	0.000361	0.016598	-0.278793	-0.085284	-0.002907
	(0.00598)	(0.00386)	(0.06829)	(0.12672)	(0.52487)	(0.02583)
	[0.01460]	[0.09356]	[0.24304]	[-2.20006]	[-0.16249]	[-0.11256]
D(LEDUA(-2),2)	0.000725	0.000500	0.012605	-0.053915	-0.060193	-0.005568
	(0.00591)	(0.00381)	(0.06744)	(0.12513)	(0.51829)	(0.02551)
	[0.12279]	[0.13104]	[0.18692]	[-0.43086]	[-0.11614]	[-0.21832]
D(LPCHE(-1))	-0.000935	-0.000316	0.007634	-0.016917	0.574642	0.004545
	(0.00148)	(0.00095)	(0.01686)	(0.03129)	(0.12958)	(0.00638)
	[-0.63324]	[-0.33112]	[0.45278]	[-0.54074]	[4.43459]	[0.71269]
D(LPCHE(-2))	-0.001175	-0.000588	0.008589	-0.000894	0.061359	0.006036
	(0.00150)	(0.00097)	(0.01711)	(0.03175)	(0.13151)	(0.00647)
	[-0.78391]	[-0.60705]	[0.50195]	[-0.02816]	[0.46658]	[0.93263]
D(LTFR(-1),2)	0.057043	-0.007744	-0.048785	0.280946	0.668017	-0.249916
	(0.04372)	(0.02823)	(0.49905)	(0.92600)	(3.83545)	(0.18875)
	[1.30481]	[-0.27434]	[-0.09776]	[0.30340]	[0.17417]	[-1.32407]
D(LTFR(-2),2)	0.000671	-0.010193	-0.047848	0.271094	-0.181497	0.003557
	(0.04253)	(0.02746)	(0.48550)	(0.90085)	(3.73126)	(0.18362)
	[0.01578]	[-0.37117]	[-0.09856]	[0.30093]	[-0.04864]	[0.01937]
LUNOUR(-1)	-0.003623	-0.002664	0.004766	0.094478	-0.069013	0.024427
	(0.00331)	(0.00214)	(0.03784)	(0.07021)	(0.29080)	(0.01431)
	[-1.09296]	[-1.24491]	[0.12596]	[1.34569]	[-0.23732]	[1.70690]
LUNOUR(-2)	0.000921	0.001059	-0.012385	-0.087355	0.026016	-0.010897
	(0.00356)	(0.00230)	(0.04065)	(0.07543)	(0.31244)	(0.01538)
	[0.25864]	[0.46055]	[-0.30466]	[-1.15805]	[0.08327]	[-0.70872]
D(LURBAN(-1),2)	-0.000332	0.000508	-0.054782	-0.000169	-0.214739	0.001418
	(0.03448)	(0.02226)	(0.39357)	(0.73028)	(3.02478)	(0.14885)
	[-0.00962]	[0.02283]	[-0.13919]	[-0.00023]	[-0.07099]	[0.00952]
D(LURBAN(-2),2)	-5.33E-06	0.001681	-0.080656	-0.022614	0.028613	-0.003958
	(0.03435)	(0.02218)	(0.39214)	(0.72763)	(3.01379)	(0.14831)
	[-0.00016]	[0.07578]	[-0.20568]	[-0.03108]	[0.00949]	[-0.02669]
C	0.030513	0.008337	0.010526	0.043764	0.560558	-0.068485
	(0.00460)	(0.00297)	(0.05251)	(0.09744)	(0.40358)	(0.01986)
	[6.63305]	[2.80680]	[0.20045]	[0.44915]	[1.38896]	[-3.44825]
R-squared	0.999961	0.228306	0.094952	0.119385	0.478507	0.297426
Adj. R-squared	0.999952	0.054403	-0.109002	-0.079063	0.360988	0.139100
Sum sq. resids	1.11E-05	4.61E-06	0.001441	0.004961	0.085114	0.000206
S.E. equation	0.000395	0.000255	0.004505	0.008359	0.034623	0.001704
F-statistic	113030.9	1.312834	0.465556	0.601594	4.071728	1.878564
Log likelihood	574.2798	612.7774	360.0033	305.6044	180.5420	445.5650
Akaike AIC	-12.66545	-13.54039	-7.795530	-6.559190	-3.716864	-9.740113
Schwarz SC	-12.18687	-13.06182	-7.316954	-6.080614	-3.238288	-9.261537
Mean dependent	4.040367	-4.11E-05	-0.000102	-0.000137	0.006319	0.000316
S.D. dependent	0.056901	0.000262	0.004278	0.008047	0.043313	0.001836

Determinant resid covariance (dof adj.)	1.67E-43
Determinant resid covariance	3.01E-44
Log likelihood	3410.428

Akaike information criterion	-74.41882
Schwarz criterion	-70.59021

Auto

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 02/20/19 Time: 22:32
Sample: 1994Q1 2016Q4
Included observations: 88

Lags	LM-Stat	Prob
1	30.60090	0.9999
2	11.52442	1.0000

Probs from chi-square with 64 df.

Normality

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 02/20/19 Time: 22:33
Sample: 1994Q1 2016Q4
Included observations: 88

Component	Skewness	Chi-sq	df	Prob.
1	2.577630	97.44791	1	0.0000
2	-0.110573	0.179320	1	0.6720
3	-0.671049	6.604501	1	0.0102
4	0.064373	0.060777	1	0.8053
5	1.205235	21.30469	1	0.0000
6	-0.022683	0.007546	1	0.9308
7	0.151531	0.336772	1	0.5617
8	0.367629	1.982216	1	0.1592
Joint		127.9237	8	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	24.87506	1754.567	1	0.0000
2	3.704497	1.819826	1	0.1773
3	10.57250	210.2570	1	0.0000
4	6.313961	40.26856	1	0.0000
5	10.03994	181.7227	1	0.0000
6	4.451093	7.720795	1	0.0055
7	3.917760	3.088373	1	0.0789
8	7.932231	89.19863	1	0.0000
Joint		2288.642	8	0.0000

Component	Jarque-Bera	df	Prob.
1	1852.014	2	0.0000
2	1.999146	2	0.3680
3	216.8615	2	0.0000
4	40.32934	2	0.0000
5	203.0274	2	0.0000
6	7.728341	2	0.0210
7	3.425146	2	0.1804
8	91.18084	2	0.0000
Joint	2416.566	16	0.0000

White

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 02/20/19 Time: 22:34
Sample: 1994Q1 2016Q4
Included observations: 88

Joint test:

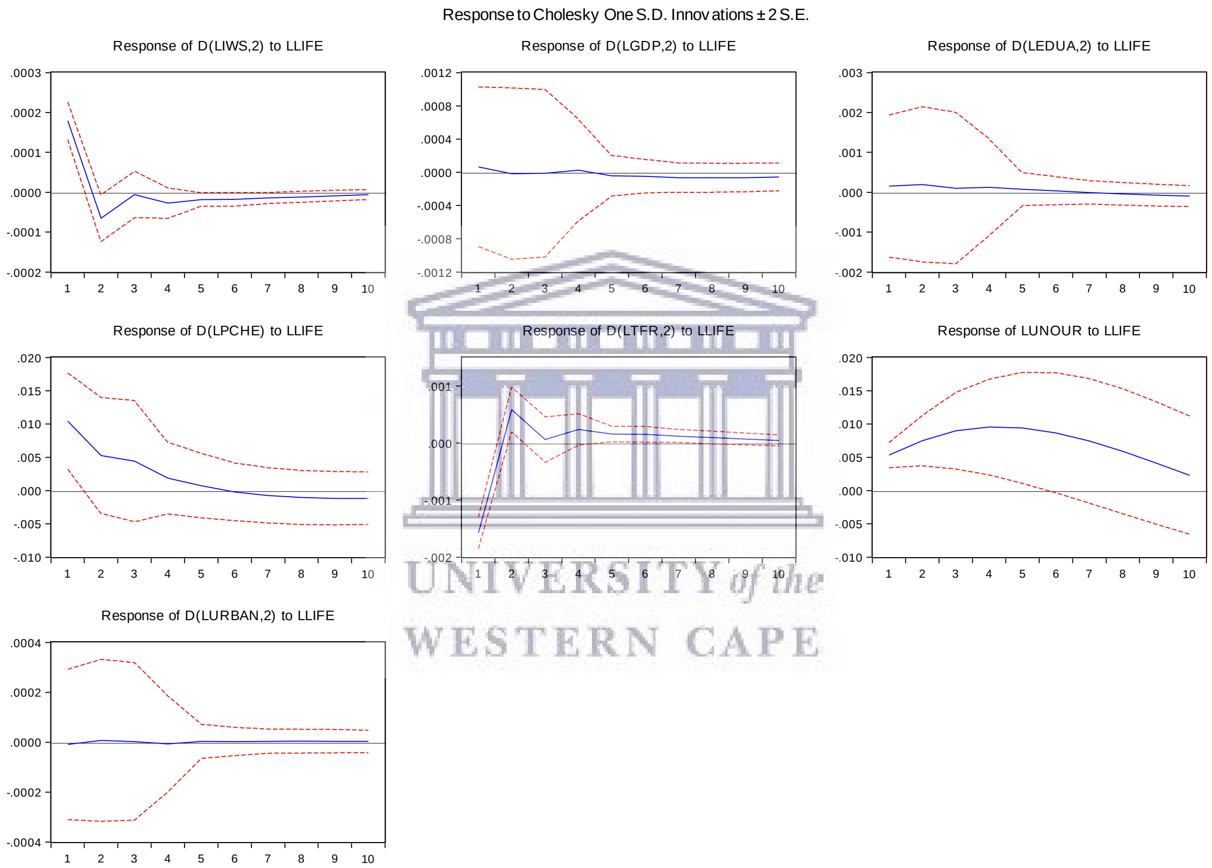
Chi-sq	df	Prob.
1190.802	1152	0.2080

Individual components:

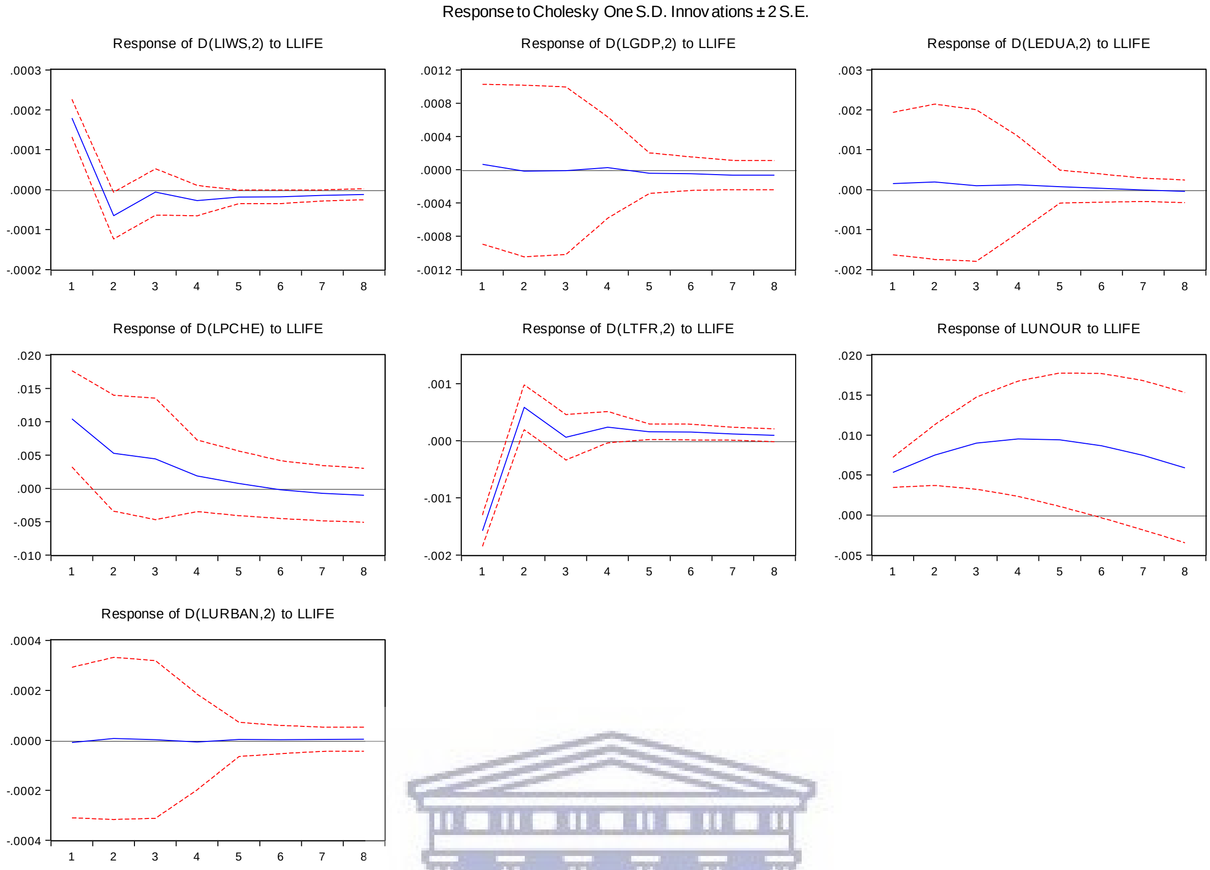
Dependent	R-squared	F(32,55)	Prob.	Chi-sq(32)	Prob.
res1*res1	0.356497	0.952176	0.5504	31.37170	0.4982
res2*res2	0.328143	0.839458	0.6988	28.87659	0.6254
res3*res3	0.471909	1.535897	0.0799	41.52798	0.1207
res4*res4	0.546762	2.073404	0.0086	48.11502	0.0336
res5*res5	0.311698	0.778336	0.7749	27.42939	0.6973
res6*res6	0.358905	0.962211	0.5374	31.58367	0.4875
res7*res7	0.345042	0.905465	0.6121	30.36371	0.5495
res8*res8	0.378786	1.048009	0.4300	33.33314	0.4022
res2*res1	0.359082	0.962952	0.5364	31.59925	0.4867
res3*res1	0.196516	0.420372	0.9950	17.29341	0.9841
res3*res2	0.414374	1.216143	0.2574	36.46491	0.2687
res4*res1	0.317959	0.801259	0.7471	27.98037	0.6703
res4*res2	0.312902	0.782714	0.7696	27.53541	0.6921
res4*res3	0.388502	1.091972	0.3794	34.18821	0.3630
res5*res1	0.283498	0.680057	0.8785	24.94781	0.8081
res5*res2	0.312124	0.779882	0.7730	27.46689	0.6955
res5*res3	0.242847	0.551268	0.9637	21.37058	0.9232
res5*res4	0.330496	0.848451	0.6872	29.08369	0.6149
res6*res1	0.361759	0.974200	0.5218	31.83482	0.4750
res6*res2	0.361273	0.972148	0.5245	31.79199	0.4771
res6*res3	0.428030	1.286215	0.2029	37.66663	0.2258
res6*res4	0.393612	1.115657	0.3537	34.63788	0.3431
res6*res5	0.317700	0.800304	0.7483	27.95763	0.6715
res7*res1	0.317568	0.799817	0.7489	27.94600	0.6720
res7*res2	0.321002	0.812553	0.7330	28.24817	0.6570
res7*res3	0.292577	0.710842	0.8492	25.74674	0.7747

res7*res4	0.435086	1.323751	0.1777	38.28761	0.2056
res7*res5	0.395992	1.126825	0.3419	34.84729	0.3341
res7*res6	0.327112	0.835539	0.7038	28.78587	0.6300
res8*res1	0.411980	1.204195	0.2677	36.25425	0.2768
res8*res2	0.235002	0.527987	0.9727	20.68014	0.9384
res8*res3	0.323431	0.821641	0.7216	28.46192	0.6463
res8*res4	0.340557	0.887618	0.6357	29.96906	0.5697
res8*res5	0.283864	0.681284	0.8774	24.98005	0.8068
res8*res6	0.243585	0.553480	0.9628	21.43544	0.9217
res8*res7	0.290476	0.703650	0.8563	25.56193	0.7826

Impulse 10



Impulse 8


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of D(LIWS,2) to LLIFE
.0003
.0002
.0001
.0000
-.0001
-.0002
1 2 3 4 5 6 7 8
Response of D(LGDP,2) to LLIFE
.0012
.0008
.0004
.0000
-.0004
-.0008
-.0012
1 2 3 4 5 6 7 8
Response of D(LEDUA,2) to LLIFE
.003
.002
.001
.000
-.001
-.002
1 2 3 4 5 6 7 8
Response of D(LPCHE) to LLIFE
.020
.015
.010
.005
.000
-.005
-.010
1 2 3 4 5 6 7 8
Response of D(LTFR,2) to LLIFE
.001
.000
-.001
-.002
1 2 3 4 5 6 7 8
Response of LUNOUR to LLIFE
.020
.015
.010
.005
.000
-.005
1 2 3 4 5 6 7 8
Response of D(LURBAN,2) to LLIFE
.0004
.0002
.0000
-.0002
-.0004
1 2 3 4 5 6 7 8