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Measuring output in government services

-An application to the public health sector in South Africa

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The main purpose of the MFS programme is to increase interest in developing countries and to enhance Swedish university students' knowledge and understanding of these countries and their problems. An MFS should provide the student with initial experience of conditions in such a country. A further purpose is to widen the Swedish personnel resources for recruitment into international co-operation.

Chalmers University of Technology administers MFS scholarships for students from all educational programs at Chalmers. The department of Technology Management and Economics is responsible for a small number of MFS scholarships for studies related to the field of industrial engineering & management.

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Abstract

Africa is an emerging market, a continent of the future. The first decade in the 21st century in Africa is often labeled the ’decade of change’, characterized by enhanced living standards and an increasing economic growth. South Africa, the economic leading edge in Africa has pursued this economic development, with a high economic growth rate and an expanding government sector. Economic growth can be measured using different methods since the measurement is done individually for each country, which affects the result. This is particularly the case for government services, as the international guidelines for estimating economic value in government services are a subject of interpretation.

This thesis aims to evaluate different methods to estimate the economic growth for government services, to highlight deviations in the results and discuss the suitableness of the methods. This is done for the public health sector in South Africa, being one of the major government services. The purpose of the study is to recalculate the value added and economic growth rate for the public health sector in South Africa.

The data gathering process was conducted during eight weeks in South Africa. In this time quantitative information about the public health sector was gathered from government authorities and interviews were conducted to add context and support the quantitative results. In total eight different interviews were held with government authorities, people with expertise in macroeconomics and employees in the public health sector. In addition to that one workshop was held at the National treasury.

The required background knowledge for the study comprises of macroeconomics and the compilation of national accounts in addition to health related indicators and statistics. This is interpreted into the political and cultural context of South Africa.

By constructing own-compiled models based on international guidelines for the estimations of components in government services, the economic value that is created in the public health sector of South Africa is calculated. This is done together with an evaluation of the productivity in the public health sector.

The results suggest that the economic value created in the public health sector as published is overestimated and that the productivity in the health sector is declining. This is due to differences in the method used at present in South Africa compared to the method introduced in this thesis. A generalization of the results to include all government services implies that the aggregated GDP of South Africa is overestimated. This gives consequences for the fiscal policy of South Africa since major fiscal variables such as government revenue, expenditure and budget balance are expressed in terms of GDP. An overestimation of the GDP also affects the structural deficit of South Africa.

The results imply that the current economic trends will continue, that is that the productivity in the health sector will decline further together with the overestimation of economic growth. The falling productivity infer that it will be expensive for the government to meet the needs in the public health sector. This is a matter to be considered for South Africa.

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”Knowledge is better than riches”
~ An old saying from Cameroon

Part I: Research presentation

Part I of the thesis introduces the area of research and method. It is initiated with the background of the study, followed by a problem analysis and the purpose and research questions. It finishes with the delimitations and methodology of the thesis.

1. Introduction

The introductory section of the thesis presents the research of the study. It is initiated with the background of the study and moving on to the core of the study in terms of problem analysis, purpose, research questions and delimitations.

1.1. Background

This section gives the background to the thesis, starting at a broad perspective with the growth and progress of Africa. From there it will narrow to describe the development of South Africa.

1.1.1. The development of Africa

The continent of Africa possesses a large share of the world scarce resources, including valuable minerals such as gold and platinum and large oil reserves. Despite these riches the continent is lacking of welfare, with over 300 million Africans living on less than one US dollar per day. The continent is subject to numerous diseases including malaria, TBC and HIV/AIDS.

The 1960s was an era of independence for Africa, with over 30 countries gaining independence from their colonial powers. The next decades were turbulent with one-party political systems, military dictatorships and economic decay as a result of instability from the rapid liberalization. The turnaround was at the end of the twentieth century, as a consequence of increased political stability in the region, including the fall of the apartheid system in South Africa, which was a trigger for a change and democracy in Africa.(NEPAD, 2012)

1.1.2. Measurement of development in South Africa

South Africa being the largest economy in Africa, it surpasses neighboring Sub-Saharan countries in purchasing power parity and gross domestic product per capita. (NEPAD, 2012) Statistics South Africa reports that the population of South Africa was 51.8 million as of 2011 which was the last measurement. It is increasing and the estimate for 2013 is about 53 million. (Mid year population estimates, 2013) The country is still emerging from the apartheid system that ceased to exist 1994, and is considered to be amongst the most divided places in the world. As measured by the GINI index (2013) South Africa has the highest income spread in the world at a level that has remained unchanged for the last twenty years. The difference in living standards and purchase powers between racial groups is South Africa is so wide that the country displays characteristics for both a developed, and a developing country. During the apartheid time the political system of South Africa was completely different. Due to this it is not of any interest to compare any present economic indicators to before 1994, since they were measured differently, or not measured at all.

The reason for this development might originate in the different political and economical climate of Africa during the recent years. However, it is dependent on the methods used to measure economic growth, since the actual measurements affects the result.

1.2. Problem analysis

In order to frame the focus for this study and explain how the research purpose and main research questions were selected, a short problem analysis is given below.

1.2.1. Sustainable growth

Since the fall of the apartheid system in 1994 the economic growth of South Africa has been high. The average yearly growth of 3.3 percent surpasses neighboring countries in the Sub-Saharan region, and the trend is that the growth rate will continue. For the last ten years the average yearly growth rate has been 3.6 percent (defined as annual percentage change in GDP) (The World Bank, 2014) and it should be noted that period includes the recent financial crisis that affected South Africa as well as large parts of the world. The high growth rate is explained by government policies in 1994 that stabilized the economy and reduced the inflation rate, attracted foreign capital, and reduced unemployment. (NEPAD, 2012)

The government services of South Africa have also shown a high growth rate, particularly during the last ten years. The average yearly growth rate has been 4.7 percent, as compared to 3.6 percent of the aggregated GDP. The high growth has expanded government services to account for 22.4 percent of South Africa economy in 2012 as compared to 19.4 percent back in 2004. (The World bank, 2014) The economic growth South Africa has displayed during these last ten years has given the country a lot of attention. As recent as 2013 the country was ranked as the top African country (fDi newspaper, 2013) due to their economic potential, and the country has been added to the list of BRICS-countries for emerging economies.

The current trends indicate that South Africa will continue to grow in the same extent as earlier. It is questionable if this growth is sustainable, real growth or if it is a result of short-term politics and the measurement of the gross domestic product. The measuring of growth is done by a country itself and as a consequence the procedure of measurement affects the result.

1.2.2. Measurement of economic growth

The gross domestic product, further referred to as GDP, is a measurement of the aggregated economic activity in a country during one year. (Eklund, 2013) It is often used to give an insight of the health of a country's economy, and when measured per capita it is also used as an indicator for standard of living. Without further describing the interpretation of GDP, it yields that GDP has a large impact on a country's economy since it affects the stock market, investment decisions, political policy- and decision making.

The GDP is very important for the fiscal policy, that is, the government use of revenues and expenditure to influence the economy. Since all major fiscal variables such as government revenue, expenditure and budget balance are published as a share of GDP a revision of GDP would affect these variables.

It is therefore of absolute necessity that GDP is measured correctly so that it actually reflects the economy. There are international recommendations on how the GDP ought to be measured in an economy, and what should be included. The country itself does the actual measurements however, often by or in cooperation with the central bank or statistical unit. Due to various reasons such as differences in allocated resources to do the measurements and available data, the actual method of

measuring GDP differs. This is problematic since GDP is used as a benchmark between countries. In South Africa the national accounts are compiled by Statistics South Africa, SSA. The compilation of the national accounts is based on the System of National Accounts, an international guideline recommended for this activity. SSA conducts the national accounts for South Africa in accordance with SNA 1993, the second most recent version of the SNA, and is in the process of updating to SNA 2008, the most recent.

Measuring the economic activity in government services is complex. This is a topic of general interest since GDP serve as a basis for decision-making. The major components of the government services in South Africa are the public health sector, public education and the police services.[1] Out of these the public health sector accounts for approximately 13 percent of the government expenditure, (The World Bank, 2014) thereof being a substantial economic part of the government services. As a consequence it is of importance that the development of the public health sector is sustainable and real.

1.2.3. Public health sector South Africa

The healthcare system in South Africa is divided into private and public health care. To access the private health care that is considered to deliver amongst the highest quality of care in the world one needs to be insured or to pay for each visit. The public health sector is not considered to be of high quality and is in many ways not comparable to the private health sector. According to the South African Health Review (2008) the public health care serves about 86 percent of the population. The diversity is a consequence of the highly unequal income distribution of South Africa.

The level of complexity to evaluate the public health sector of South Africa is an issue, since the public health sector accounts for a substantial economic part of the government services. As stressed it is importance that this is done in such a way that it truly reflects actual changes. This is essential in order to be able to allocate resources efficiently to the public health sector, and to make decisions based on trustworthy and accurate information.

[1] Interview National Treasury

1.3. Purpose

The purpose of the study is to recalculate value added and economic growth rate for the public health sector in South Africa.

1.4. Research questions

Three main research questions have been constructed to meet the purpose. These cover the areas of productivity measurements, the sustainability of the economic growth and possible generalizations of the study.

Research question 1:
How is value added calculated for the public health sector at present in South Africa?

Research question 2:
How has the performance of the public health sector developed during the recent years in terms of productivity and output and what is the predicted forecast?

Research question 3:
What are the effects if the recalculated value added for the public health sector is reviewed in a wider perspective to include all government services?

1.5. Delimitations

It is not possible to investigate the economic growth for all government services in South Africa at a level that gives a satisfying result in the given time period. Therefore the study will be delimited to contain crucial parts of the government services, namely the public health sector. This sector is selected due to its importance and the assumption that it is possible to determine the value added in this sector.

The study is delimited to a certain time period. This is based on the data that is available in order to give accurate results. The selected time period that is used for calculations and growth estimates is 2001-2011, though discussions and conclusions contain a larger timespan.

All the raw data used for computing the economic growth in the public health sector will not be validated due to the vast amount of data that would have to be processed and evaluated. Instead the study will focus on data from public hospitals since this is the main component in the public health sector of South Africa.

2. Method

This section describes the methods used in the study in order to satisfy the purpose and research questions previously stated. The section will end with a discussion of the legitimacy and validity of the data and methods utilized.

2.1. Introduction

A pre-study has been conducted as a basis for the study. The purpose was to increase the understanding of the issue and be able to focus resources accordingly. The initial line of action was to study the political and institutional context of South Africa in order to get a perspective on the problem and its consequences. Research was done on how institutions in South Africa calculated GDP at constant prices and how output was currently estimated in the government services. Information was gathered on whom had information that was necessary for the study, and initial contact was made with these individuals. This resulted in a line of action for the study and the procedure that was used to answer the research questions.

2.2. Line of action

The first step in the process was to strictly define the scope of the project since the economic growth rate can be recalculated for all areas of government services in South Africa. This was done by an on-going dialogue with an expert experienced in constructing national accounts and economic forecasting for developing countries in the Sub-Saharan region. (see appendix 2) This resulted in focusing the study on the public health sector.

Eight weeks were spent in South Africa for the conduction of the thesis. During this time eight interviews were held with people and organizations of relevance to the study. During the first weeks in South Africa interviews were held with individuals associated with the study from Statistics South Africa and The National Treasury in South Africa. These interviews were recorded and conducted with the purpose to investigate how output is measured in the public health sector and to acquire data in order to construct our own models for calculations of output. After the interviews the following procedure was to examine and process the data and construct models. This was done based on the theory presented in the theoretical framework about productivity and efficiency measurements in government services and on available data. The models were built according to the divide and conquer principle (Gimel, 2013) and each step was validated.

In parallel to the construction of the model an interview was conducted with *Weskoppies hospital* situated in Pretoria. There were multiple purposes of this interview, foremost to apprehend a broader perspective on the issue, to get insight on how the data used were gathered and transferred, and to gain the perspective of the hospital staff. Understanding the way that the data was recorded and transferred was necessary for validation.

At this stage complementary data were collected via official documents and mail conversations with individuals previously engaged in the study. The models were created together with the data gathered and the political and cultural context of South Africa. This resulted in the analysis and led towards the conclusions.

During the final week in South Africa a workshop was held with the key individuals associated with the study. The workshop was conducted at the National Treasury with the fiscal department and the research department. The workshop was initiated with an interactive presentation of the findings.

This was followed by a discussion about the economic growth rate of South Africa. The workshop had two major objectives; the first to get feedback on the findings and to get others perspective on the issue. The second and equally important objective was to spread the findings and awareness of the issue to key individuals in South Africa, in order to generate a lasting impact.

The final step in the research was to identify shortcomings, potential areas of improvement and ideas of how to conduct these.

2.3. Data gathering

There are several different types of data and methods to gather it. This section will describe the main procedures used for data gathering for the study and discuss the quality of the collected data. The data gathering process is divided into the collection of primary and secondary data.

2.3.1. Primary data

Primary data is information that is gathered explicitly for a specific study that is conducted. This means that primary data is crucial for the result of the study, although the gathering process often is time consuming. (Björklund & Paulsson, 2007) The primary data that has been gathered consists of conducted interviews and the collection of quantitative data in terms of excel-documents containing information about the public health sector of South Africa.

Interviews

Interviews have been essential for the study since it is not possible to fully grasp and examine the issue from a quantitative perspective. Therefore interviews have been conducted with several government authorities in South Africa (see table 2-1) to better understand the situation and get a broader perspective. The interview procedure used was to have an initial interview followed by mail conversations with more specific questions and in some cases follow-up interviews.

By conducting semi-structured interviews the risk of misunderstanding is reduced by letting the interviewee speak freely. In a semi-structured interview the questions are more general and the sequence of questions could be varied. (Bryman & Bell, 2007) According to Gillham (2000) semi-structured interviews are characterized by the possibility for the interviewee to speak freely and follow-up questions by the interviewer based on the replies. This interview form was selected on beforehand to best suit the purpose for the conducted interviews.

All interviews have been recorded if approved by the interviewee, and the recordings have been used to clarify facts and reduce misunderstandings. The conducted interviews had no time limit as decided on beforehand. In table 2-1 is a description of all interviews.

Organisation	Position	Place	Time (min)
Statistics South Africa	Head of national accounts	Statistics South Africa	55
	Head of employment statistics	Statistics South Africa	12
	Manager for government service expenditure	Statistics South Africa	8
National Treasury	Chief director: Public finance	National Treasury	83
	Chief director for health and social development	National Treasury	49
	Associate: Health and social development	National Treasury	37
Independent consultant	Compiles the national accounts for Lesotho		50
Independent consultant	Independent consultant in economic statistics and economic modeling	-	-
University of Pretoria	Principal pathologist and medicinal practitioner	-	31
Weskoppies hospital	Deputy director	Weskoppies hospital	128
(Group interview)	Finance manager	Weskoppies hospital	128
	Nursing manager	Weskoppies hospital	128
	HR manager	Weskoppies hospital	128
	Quality manager	Weskoppies hospital	128

Table 2-1: Interviews

Workshop

Workshop is an effective way to gain the perspective of others and to reflect upon the presented issue. It could be used to work out new results or to discuss the validity and reliability of existing ones. Workshops could therefore be used both to verify data and to create new data and results from discussion. The workshop held at the National Treasury was initiated with an hour long presentation of the study and findings where the attendants could ask questions. This was followed with a discussion and possible ways to use the findings in future work for the National Treasury.

Quantitative data

This section describes the procedure for data aggregation in the government sector of South Africa. There is a discussion about the availability and quality of the data and how this has been managed to validate it. The data referred to in this section is quantitative data gathered in excel documents containing information about public health performance indicators.

Data aggregation process

The data is gathered locally at hospitals and other public health institutions and sent to the local government. The local governments then processes the data and provide it to the provincial

government, which finally send it to the department of health where it is aggregated. The aggregated data is then distributed to different government authorities that require it, including the National Treasury where a large part of the data for this study was obtained. The link from the local hospital where the data is gathered until it is aggregated at the national department of health includes a number of steps where data could be lost or incorrectly interpreted since there are few guidelines on data collection and processing.

The data is inadequate in the way that there are multiple documents and spreadsheets that aim to provide the same data, but the actual numbers vary. In some cases the data varies a few percentiles, whereas sometimes it differ up to 30 percent. This is due to the limited guidelines and recourses for data collection and processing, including old IT-systems. Since only a small portion of the data is published very limited resources are spent on validating the data which also adds up to the problem. Using the method of triangulation (Patel & Davidson, 2011) this issue has been resolved by using matching data, meaning data that is backed up from multiple documents, or from sources that are considered reliable by the government authorities.

2.3.2. Secondary data

Secondary data is referred to as information that is not compiled specifically for the study, such as statistic publications or general theory in the field. Since secondary data is not explicitly gathered for the study it must be considered that it can be biased or outdated. (Björklund & Paulsson 2007) The secondary data used in the study is presented in the following text.

Literature research
The initial focus of the literature study was to identify international guidelines for the compilation of the national accounts for government services, since this is the fundamental part of the study. This was done in order to obtain basic knowledge on how the national accounts for government services are constructed. The information from these frameworks is a baseline for the data required.

There has been a search for articles with similar purpose as the conducted study. This includes articles about the difficulties to estimate value added for the government services as well as articles about the South African economy and estimations of the productivity and economic growth for the public health sector in South Africa. Keywords used for these searches include ’government services’, ’productivity public health’ and ’government health policies’.

2.4. Validity and reliability of the study

The fundamental part of the study is the estimation of components of the national account for government services. These estimation leading to the results of the study are based on various calculations of quantitative data. However interviews have been conducted to apprehend a broader perspective and gain the insights of the workforce and management as well, to support the claim and backup the results obtained by the quantitative calculations. This means that the study has both quantitative and qualitative element. The qualitative data are validated from its trustworthiness, whereas the quantitative data is statistically validated in the sense that it is possible.

2.4.1. Trustworthiness

According to Bryman & Bell (2011) trustworthiness is a usual indicator for qualitative studies. It can be divided into four categorizes that will serve as a base to demonstrate the validity for the

qualitative part of this study. These four categories are credibility, transferability, dependability and confirmability.

Credibility

The credibility of a study determines how believable the results of the study are and how well they capture the reality. Several measures have been used to increase the credibility of the qualitative elements in the study.

In order to increase the understanding of all interviews they were recorded and the recordings were used to eliminate potential doubts. Notes were taken during the interviews and for the more substantial data sources several interviews were held to improve the understanding of the subject. All quotes used in the thesis were checked through the recordings to ensure their correctness, and the interviewee was asked for their approval to publish the quote. All interviews were held in English which increase the risk for misunderstandings since it was not the native language for either the interviewer or the interviewee in most cases. The risk for this was reduced using triangulation (Patel & Davidson, 2011) by interviewing several sources to obtain the same information and cross-checking the results.

Transferability

The transferability of a study determines the context in which the results can be used, such as under what prerequisites the results are applicable and who the results might concern. (Bryman & Bell, 2011) This study is focused solely on the public health sector in South Africa and could have been more extensive, although possible generalizations of the results are discussed. In order to make the study and the results transferable detailed information about the methods and shortcomings of the models are discussed, and under what premises the results are valid. There is a discussion about how the scope of the study could be extended to include additional government services and how similar studies could be conducted in neighboring countries.

Dependability

Dependability describes whether the achieved results are a product of the authors and the working process rather than unbiased methods and data. To assure the dependability of the study the line of action and methods used have been thoroughly discussed and work have been done of the authors independently and discussed.

Confirmability

Confirmability is the term used to ensure that the findings are unbiased from the authors personal views and values. For a qualitative study with analysis and recommendations it is difficult to make the distinction between direct results and personal conceptions which is problematic. The confirmability of the study was assured by conducting a workshop at the National Treasury together with key individuals that had worked with the study and discussing the results. This was used to distinguish personal opinions and precipitous conclusions from objective results and to gain multiple perspectives on the issue. The thesis was initiated by an independent consultant in South Africa with vast knowledge on the subject, and discussions were held with a former SCB employee with expertise in this field. This expertise improved the resource allocation of the thesis to focus on crucial parts. This might result in that the findings are biased since the study has been conducted in close cooperation with this consultant.

Part II: Theoretical framework

The second part of the thesis aim to present the theory that lays the foundation of the study. This is initiated with macroeconomic theory of the compilation of the national accounts. Finally, productivity theory is presented together with indicators used in the thesis and a discussion about sustainability.

3. Theoretical framework

This section provides the theoretical framework and knowledge required to understand the later sections of the report. Initially is a description of the System of National Accounts and the gross domestic product, followed by definitions of productivity and methods to estimate it. That is followed by a structural description of the South African government and the public health sector in South Africa.

3.1. System of National Accounts

The System of National Accounts, SNA, is a statistical framework compiled by the United Nations, the European Commission, The International Monetary Fund, The World Bank Group, and the Organization for Economic Co-operation and Development. The purpose of the SNA is to serve as a guide for policymaking and analysis for macroeconomic accounts. The intention of SNA is to be applicable by all countries and to ensure that national accounts in different countries achieve consistency. It is considered to be the international standard for guidelines regarding the national accounts and is encouraged to be used by all countries. The most recent version of SNA was published in 2008, whereas the previous version was published in 1993. SNA 2008 is used to describe the construction of the national accounts.

3.1.1. Gross domestic product at current prices

The intention of GDP is to measure all economic value created within some specified borders, in the case of GDP a specific nation's borders, during a certain time period. The most usual case is to calculate GDP per annum or per quarter. (SNA, 2008) Thus the calculation of GDP includes economic activities such as private and public consumption, government spending, investments and exports. These activities can be further divided into sub groups, whereas the value added for each sub group aggregates to the total GDP in the country. The created economic value, further referred to as value added can be computed using different methods which aim to give the same results. The most intuitive of these methods calculate value added by taking the sales price for a good or service, and subtracting the economic value of the raw material, called *intermediate consumption*. Values are expressed in local currency and are additive across products. Equation 3-1 shows how the value added is calculated.

Equation 3-1: value added = output – intermediate consumption

Value added in the private sector is calculated according to equation 3-1 by deducting the intermediate consumption from output. The value added of government services however cannot be computed by equation 3-1 since the gross output of the government services seldom generate any revenues. Output provided by the government are services like public health care, education, national defense, which does not generate any revenues itself but is necessary for the country as a whole. This adds complexity to the calculation of the government sectors' contribution to GDP since the ordinary way to compute it is based on the economic value of output.

Equation 3-1 calculates the GDP at current prices, meaning that it gives the nominal value of GDP. Since prices usually increase over time due to inflation, this does not give a fully accurate picture of the changes in economic activity. Assume that the GDP of a country has increased with twenty percent during the last five years, and that during the same time period the inflation rate has been

ten percent. This gives a *real* change in economic activity with ten percent, in contrast to the *nominal* increase of twenty percent.

3.1.2. Gross domestic product at constant prices

GDP is used in a variety of contexts and for multiple purposes, internally in the country and to benchmark against other countries. In order to be able to do so, GDP must be measured in real value, referred to as *GDP at constant prices*. To calculate GDP at constant prices a base year is used and all economic value is expressed in the prices of that year. (SNA, 2008) The base year is usually updated every five years. This is necessary due to changes in production structure, consumption patterns, larger quality changes and appearances and disappearances of products. It is not operable to compare goods and services from periods that are far apart. When the base year is updated all the historic values of GDP at constant prices need to be updated along with it.

GDP at constant prices is calculated by removing inflation from the GDP at current prices and to adjust for changes in quality, to estimate the real change in economic activity. Adjustments for change in quality are necessary since if the quality of a product increases over time but the price of it declines due to a competitive market situation, the created economic value have increased and the GDP at constant prices should increase with it. (SNA, 2008) The relative changes in quality over time is complex to measure, usually indexes are used[2] to describe quality changes in industries over time. To do it at a more detailed level would require a vast amount of time and would still not give accurate results.

To transform the GDP at current prices to constant prices *deflators* are used, which gives a ratio of the price inflation/deflation of GDP with respect to the deflator base year. The following section gives a description of deflators.

3.2. Deflators

There are three commonly used methods to transform GDP at current prices to constant prices, called *revaluation, deflation and extrapolation.* (SNA 2008) Revaluation uses the price of the base year and considers changes in quantity. The deflation method adjusts for changes in price by dividing the current value with a price index of the base year. Extrapolation uses the same technique as deflation but consider the changes in quantity, multiplying the base year value with a volume index. Equations for the different methods is as follows:

Revaluation: Equation 3-2: $GO_{0,t} = Q_t P_0$

Extrapolation: Equation 3-3: $GO_{0,t} = Q_0 P_0 \frac{Q_t}{Q_0}$

Deflation: Equation 3-4: $GO_{0,t} = \frac{Q_t P_t}{\frac{P_t}{P_0}}$

GO is the gross output, and $GO_{0,t}$ is the gross output of period t at constant price of period 0. Q being the produced quantity and P being the price per unit.

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[2] Interview Lennblad, A.

Revaluation requires detailed knowledge about produced quantities which limits the usage mainly to the agriculture sector. Price deflation is generally the preferred technique since it is easy to incorporate new products and activities because the current price data is sufficient. Volume extrapolation is commonly used in the case of hyperinflation, when it is more difficult to estimate and adjust for inflation. The cons with volume extrapolation are that it is difficult to define the unit of quantity (especially in the service industry) and it is difficult to adjust for changes in quality since it is the quantity that is the relative measure. (SNA, 2008)

As stated previously GDP is calculated as the difference of output and the intermediate consumption. In order to get GDP at constant prices the output and the intermediate consumption should be in constant prices which is usually obtained by deflation or extrapolation. The calculation of GDP at constant prices as the output at constant prices minus intermediate consumption at constant prices is thereby called *double deflation* since both of the components are deflated separately. This technique is commonly used if there is reliable price and volume data available.

3.4. Accounting guidelines for government services

The general government of South Africa is a non-market producer in the sense that services provided are not sold at economically significant prices. The definition of economically significant prices is by SNA 2008 "*...prices that have a significant effect on the amounts that producers are willing to supply and on the amounts purchasers wish to buy.*" In other terms, prices set by the economic market where producers and consumers act. The economic output is the value created in the production process, defined as quantity produced multiplied the sales price per item, as presented in Equation 3-5)

Equation 3-5: $\text{Output} = P \times Q$ with P being the sales price, and Q the produced quantity.

The intermediate consumption is the aggregated value of all material required for the production process. This means that value added is the actual economic value that is created during the production process.

This is an intuitive method to calculate value added and it is used for market producers. For non-market producers this approach is not possible since units do not produce to sell at economically significant prices. Often the services supplied by non-market producers are provided free of charge. Using this method for non-market producers would imply that the economic output is zero and the value added component is negative with the magnitude of the intermediate consumption. Due to this alternative accounting methods have been used to calculate the value added for non-market producers.

3.4.1. Accounting guidelines SNA 1993

The issue to estimate value added a for non-market producer is a consequence of that the output is not produced at economically significant prices. The input however is measured in the same way as for market producers. This was used in earlier versions of the SNA, up to SNA 1993 to bypass the issue of the absent value of output. In SNA 1993 the output for non-market producers, including the government services which is the single largest factor, was calculated as the estimated sum of production, broken down into four components:

-Intermediate consumption
-Compensation to employees
-Consumption of fixed capital
-Other taxes (less subsidies) on production

The value added is then calculated as output minus intermediate consumption. This results in that value added for non-market producers according to SNA 1993 and earlier versions of SNA is calculated as the sum of compensation to employees, consumption of fixed capital, and other taxes on production. (SNA 1993) This method is called the cost method. This implies a unit productivity of one, since productivity is defined as the ratio between input and output. This is a premise that will be discussed in the report and what consequences that follow.

3.4.2. Accounting guidelines SNA 2008

In SNA 2008 various updates have been done for the estimation of output for non-market producers. For output at current prices the same input-based method is used, but there are significant changes in the estimation of output at constant prices. There are general rules and also more specific guidelines to be used. This section will cover the updated guidelines for the public health sector since this will be the main focus of the report.

The particular method recommended for individual services such as health care and education is called the *output volume method*. It states that output should be calculated with a volume index that take the output of all services and goods produced into account, and the index should measure changes both in quantity and quality of production. The different outputs should be weighted in the index according to their resource intensity. In order to create indicators that fully capture changes in output volume, two criteria should be met according to the SNA 2008. The indicators should include the full range of activities and all changes in costs and quantities must be considered, including updates in the weights according to resource intensity. The second criterion is that all indicators should be adjusted for changes in quality, meaning that all activities must be divided into homogenous groups in order to be comparable. Since this requires a vast amount of accurate data and resources it is recommended to be tested and evaluated before implementation. This method is called *the production method*. In the thesis value added for the South African public health care is estimated by a version of the production method

In order to give meaning to all terms an application will be provided for the health sector. Input is defined as the labor of all staff, the medicines and drugs used, the consumption of fixed capital such as wear of buildings and equipment, cost of electricity and everything else the hospital need to function. Activities are the operations performed such as child births, surgeries, or the examination of a patient. Outcome is dependent on a number of factors and is defined as the result of the activities performed and the perceived service that is received by the patient. Outcome differs from output. The output refers to the quantity produced, whereas outcome is the result of the activity. This is illustrated in example 1 in section 3.8.1.

The Performance paradox
Indicators are used in this thesis to evaluate different properties of the public health sector in South Africa. Using indicators for the measurement of an activity or process, it is necessary to take into account that indicators not always accurately measure the performance of the activity or process it is meant to. This is further described in the performance paradox (van Theil, 2002)

The performance paradox discusses the potential differences between performance indicators and actual performance. This is caused by the tendency of performance indicators to decrease in accuracy over time, which results in a weakened correlation between performance indicators and the actual performance. This is caused by four processes named positive learning, perverse learning, selection and suppression.

Positive learning is the process of performance indicators losing sensitivity in detecting bad performance because of a general increase of performance. Perverse learning is the process that occurs when organizations, staff groups or individuals learn over time what aspects of performance are measured and use this information to manipulate the performance assessment. This is conducted by putting greater efforts into the activities that are measured. This results in higher measured performance though no actual improvement exists. Van Thiel states (2002) selection as *"the replacement of poor performers with better performers, which reduces differencesin performance. Only good performers remain, and the indicator loses its discriminating value".* Suppression is the process when differences in performance are ignored.

This is illustrated in The performance paradox in the public sector by van Thiel (2002), she writes:

> *"In the British National Health Service, it was agreed that patients should be on a waiting list for an operation no longer than 2 years. This measure appeared successful, as the average waiting time decreased. However, on further inspection it was found that the waiting time only beginning after the first hospital consultation was postponed to decrease the waiting time (perverse learning). In fact, the average waiting time did not decrease at all but was merely shifted in time. The indicator did not accurately reflect performance; it reported an improvement where there was none."*

3.5. Indicators used

This section will introduce the indicators used in the report, including a description of how they are compiled and their usage throughout the report.

Patient day equivalent

Patient day equivalent, further referred to as PDE, is a measure of the number of patients treated by a hospital over a certain period of time. One patient day equivalent equals the average amount of resources consumed by a patient staying at the hospital for 24 hours. Three different patient categories are used to calculate PDE. These are *inpatient days*, *day patients* and *outpatient and emergency room visits*, weighted according to their resource intensity. Inpatient days (IPD) is the number of days spent in the institution for all admitted patients during a specified reference period. A day is measured at midnight. A patient admitted and separated on the same date has zero patient days. Day patient is defined as a patient admitted and discharged before midnight on the same day.

The weights for the different categories are used to calculate PDE according to equation 3-6.

Equation 3-6*:* $\text{PDE} = 1 \times \text{inpatient days} + 0.5 \times \text{daypatients} + 0.3 \times \text{outpatients}$

Cost per PDE

Cost per PDE is an indicator designed to reflect to what extent a hospital (or the entire health sector) is being optimally managed. The indicator uses both input and output data and is a measure for

productivity. The input data consist of the total expenditure and the output measure consist of the PDE.

Equation 3-7: $\text{Cost per PDE} = \frac{\text{expenditure}}{\text{PDE}}$

Separations

Separations is defined as the release of a patient from the hospital and includes the number of inpatients dying. In contrast to discharges the number of separations includes the patients that released from the hospital the same day. (Health at a glance, 2013)

Average length of stay

Average length of stay (ALOS) measures the average length a patient spends in a hospital. It is used to measure efficiency (Health systems trust, 2014) in the sense that if all other factors are equal, a shorter stay indicates that resources are used more efficient. In South Africa ALOS is calculated by dividing the number of inpatients days by the number of separations, including transfers, discharges and deaths.

Equation 3-7 $\text{ALOS} = \frac{\text{IPD}}{\text{separations}}$

Number of Hospital beds

Number of Hospital beds (NHB) is a measure of resources available for delivering services to inpatients in hospitals by measuring the number of available beds. (OCED, 2001)

Bed utilization rate

The bed utilization rate is a measure of the occupancy of the available beds. It is defined as the average percentage of occupied beds in a health facility and is calculated per annum.

Primary health care visits

The number of health care visits (PCH visits) is defined as the number of visits to a primary health care facility. To give the PHC visits for the entire public health sector the data is aggregated for all public health facilities. (Healthlink, 2009)

Real cost per visit

Real cost per visit is a performance indicator for the health sector stating how much the cost is for each visit to a public health facility. This is calculated according to equation 3-8.

Equation 3-8: $\text{Real cost per visit} = \frac{\text{real expenditure}}{\text{PHC visits}}$

Intermediate consumption

Intermediate consumption is the goods and services used up during the production process. (SNA, 2008) In the health care intermediate consumption refer to drugs, medicinal equipment, and other consumable items used at health facilities.

Compensation to employees

Compensation to employees is the compensation to the workforce. This consist of wages and bonuses to employees in the health sector alike other government services.

Consumption of fixed capital
Fixed capital have finite life length. Due to this some part of the value added created in the production process should be regarded as the reduction in value of fixed capital. (SNA, 2008) In the health care industry this would be the reduction of the value of equipment such as x-ray machines and surgery instruments.

Other taxes (less subsidies) on production
As the name indicates this is taxes that are added for the production process, the same definition applies for health services. (SNA, 2008) Out of the four components of the government expenditure this is in general the smallest.

Number of hospitals
The aggregated number of public hospitals in South Africa.

3.6. Production processes

A general description of a production process is shown in figure 3-4. The process consists of an input into the process, thereafter the transformation of these inputs which result in an output and outcome.

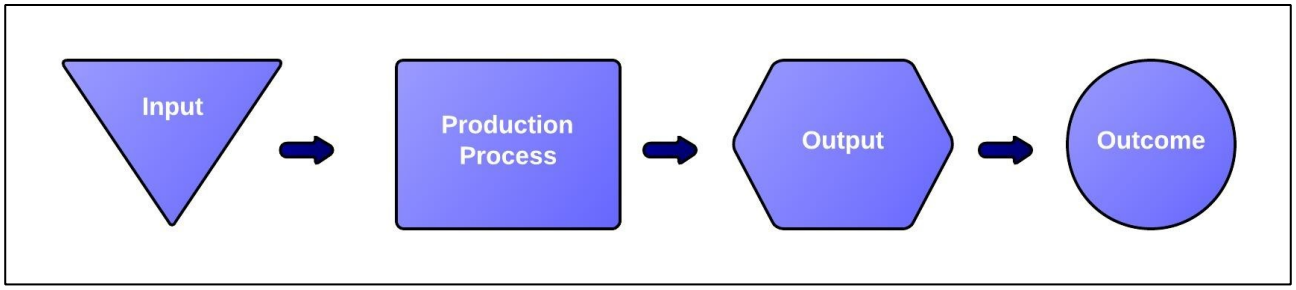


Figure 3-4

3.7. Productivity

The term productivity is used in a wide variety of contexts. Productivity is used in production of goods and services as a measurement. A formal definition of productivity commonly used is that it is the ratio between input and output of a process. It is commonly linked to the efficiency of a process. There is said to be a general understanding in productivity literature that this definition is correct but it is also stated that there is no unique purpose nor a single measure of productivity that is generic, (OECD Manual on measuring Productivity, 2001)

Equation 3-9: $\text{Productivity} = \frac{\text{output of operation}}{\text{input of operation}}$ (Slack, 2010)

Measuring productivity in developing countries
There are several challenges with measuring the performance in government services associated with developing countries. The availability and quality of data may be inadequate or not considered trustworthy. The challenges affiliated with working with government services in development countries are discussed by Mcintyre (2005) in the report Technical efficiency and productivity of public sector hospitals in three South African provinces. Mcintyre states the main problem as the

inefficiency in government services and the unequal distribution of resources, making productivity measurements difficult. This issue is managed by Mcintyre by measuring productivity in relative terms rather than absolute terms. That is, different units are compared to each other instead of establishing the absolute productivity for each unit.

Zere (2000) uses a similar approach in the article Hospital Efficiency in Sub-Saharan Africa – Evidence from South Africa. In the article Zere distinguishes the specific difficulties with measurements in the health sector. He writes *"Measuring efficiency and productivity in the health care sector is complex due to the nature of the production process. Measuring improved health status is intricate, due to the health status being influenced from an extensive amount of factors not controlled by the public health sector"*

Zere provides an analysis of the productivity in the public health sector South Africa using a DEA (Date Environment Analysis) framework. This framework enables the calculation of the theoretically optimal productivity and compares the different units' (in this case different hospitals) performance.

3.8. Production in health sector

In the field of the public health sector measuring productivity is important for a couple of reasons. In order to achieve efficient allocation of resources in the health care sector accurate measures of health care output and productivity are essential. It is required so that decision makers can take decisions based on performances and the development of processes over time.

3.8.1. Production processes in health sector

The production process in the health sector can be described to follow the same sequence as the general production process. There are different kinds of inputs, outputs and outcomes. An illustration of the production for process for the health sector is given below to clarify.

Example 1: Production process in the health sector
An individual breaks a leg and needs medical assistance. These are the activities that the production process consists of:

- Emergency receives a call and send out ambulance
- Ambulance provides first aid and delivers person to hospital
- Accident and emergency ward evaluates the injury
- Movement of the leg is restricted, using either a splint or cast
- Medications are prescribed to reduce pain and inflammation
- Recovery is monitored, either in primary care or outpatients
- The splint or cast is removed after the healing process

Inputs are here divided into three categories, labor, capital and intermediate consumption. Labor is the recourses spent on personal such as doctors, nurses, emergency personal, administrative staff and support staff that are engaged in the different activities described in the example.

Intermediate consumption includes the medical supplies and other forms of consumables such as electricity, petrol, water. Capital includes the buildings that are owned and the ambulance.

The output is the treated patient and the outcome is the result of how well the individual can return to work and social life with full mobility.

3.9. Input and output in health sector

The inputs in the health sector is the sum of the expenditures and other input resources, described further in section 4.4. Expenditure in the health sector is as stressed previously the sum of compensation to employees, intermediate consumption, consumption of fixed capital and taxes on production.

The measurement of output in the public health sector varies in different countries . In this section two different methods are described to give an overview of measurement systems that are used.

3.9.1. Cost method

The cost method for measuring output is the method described in the SNA 1993. (See section 3.4.1.) It is used in a number of countries and is widely used in Africa. As descried later in section 4.2. South Africa uses a version of the cost method to estimate the output for the government services. Using the cost method, value added for all government services including public health is calculated according to equation 3-1.

Equation 3-1: value added = output − intermediate consumption

Equation 3-10:

$$\text{Output} = \text{compensation to employees} + \text{taxes on production} + \text{consumption of fixed capital} + \text{intermediate consumption}$$

Equation 3-11:

$$\text{Input} = \text{compensation to employees} + \text{taxes on production} + \text{consumption of fixed capital} + \text{intermediate consumption}$$

As can be seen from equation 3-10 and equation 3-11 input equals output in the cost method. This implies a unit productivity of one, since productivity is defined as the ratio between input and output.

In order for this to be accurate certain criteria must be met. The data collection must be correct and all resources must be used 100 percent of their available time, indicating that bottlenecks, stops in production, transport times cannot exist. This is rarely the case for production processes, including government services and the public health sector.

3.9.2. Output based

An output based method aims to estimate the actual output that is produced during a process. A fair number of countries have implemented or are in the process of implementing the SNA 2008 which results in a need for a new form of measuring-system for measuring output in the public health sector.

This new form of measuring is based on case-mix, case-mix is often referred to as “the mix of patients treated by a hospital” (Department of Health Australia, 2014). The idea of case-mix and its useful properties for statistics was stated as early as in 1913 by Dr Eugen Codman. (Miriam Wiley, 2011)

> “*Really the whole hospital problem rests on one question: What happens to the cases? [. . .] We must formulate some method of hospital report showing*

> *as nearly as possible what are the results of the treatment obtained at different institutions. This report must be made out and published by each hospital in a uniform manner, so that comparison will be possible. With such a report as a starting-point, those interested can begin to ask questions as to management and efficiency*."

This measure of case-mix, serves as a basis for a measurement system called a DRG-system. DRG is an acronym for Diagnose Related Groups, which was developed in 1960s by Robert B. Fetter, Yale School of Management, John D. Thompson, and their colleagues. (Newman, L, 2013) The purpose was to use the DRG-system for quality control, but due to increasing health costs the DRG system evolved to also measure cost control and resources allocation.

According to "Diagnosing the cost and efficiency of healthcare delivery through Diagnosis Related Groups (DRGs), Deloitte", most high income countries use some form of a DRG or case-mix based payment system in the health sector.

The basic outline of the DRG system is the use of case-mix combined with the calculated resources used for treatment for individual diagnoses. Diagnoses are categorized, often to a large extent applying the ICD-10 (International Statistical Classification of Diseases and Related Health Problems). Diagnoses that are medically similar, use related recourses and an equal amount of these are aggregated into DRG. Thereafter the resources used per individual DRG are calculated. By aggregating all DRG groups in terms of number and expenditure, the output can be calculated.

The DRG system has a number of useful properties that can be applied on a health facility level as well as on a national level. A DRG system measures what, how much, and the resources used in the operations of a hospital or an entire sector. This can be used for bench-marking, budgeting, productivity measurements, performance assessment and output measurement. (Socialstyrelsen, 2011)

Sine case-mix data does not exist at an aggregated level in South Africa, the DRG-system cannot be used although it would be preferred. The method used in this thesis is based on the data that is available.

3.10. Measuring outcome

Outcome is defined as the stated that is reached after an event, and is dependent of multiple factors. In health care the outcome of a patient is dependent of other factors than the health output, such as the initial physical condition of the patient, sanitation and alcohol consumption. This makes it difficult to separate the causes of outcome into the output of the service received and to other causes that is individual for the patient. Since it is difficult to make such distinctions it is recommended that outcome is not taken into account for any measurement models. (SCB, 2008)

3.11. Sustainability

When breaking down the term sustainability it comes to three main components, social, economic and environmental sustainability. Each of these dimensions is important to fulfill in order to be sustainable. Social sustainability is the ability of a community to develop processes and structures which not only meet the needs of its current members but also support the ability of future generations to maintain a healthy community (Brundtland commission, 1987) and is an important aspect to consider for corporations and institutions, not to mention for politicians. Economic

sustainability the BusinessDictionary (2014) gives the following definition: ”The use of various strategies for employing existing resources optimally so that that a responsible and beneficial balance can be achieved over the longer term. Within a business context, economic sustainability involves using the assorted assets of the company efficiently to allow it to continue functioning profitability over time”.

This particular research is directly linked to the social and economic sustainability of South Africa. These dimensions of sustainability are taken into consideration together with the discussions of the findings. The thesis does not further discuss the environmental impactions of the results since there is no distinct connection to be made.

As stated in Alänge (2014), there is currently is an emerging understanding among scientists, industrialists and politicians about the necessity of the world to reflect over sustainability. Initiatives taken by individual companies and customer groups to reduce their environmental footprint are emerging. Government services are not isolated from the issue of environmental sustainability and should use sustainability as a driver for innovation.

Part III: Empirical results

In the third part of the thesis the empirical results are presented. The performance of the public health sector is evaluated through the development of the presented indicators. The public health outcome of South Africa is presented and the part is ends with the calculation of value added for the public health sector.

4. Introduction

This section presents the empirical results of the research. It is initiated with a review of the structure of government sector in South Africa, followed by a presentation of the models used to evaluate the performance and estimate the value added of the public health sector. These models are constructed to be aligned with SNA 2008 to the furthest extent possible. The section will also cover the development over time of public health outcome for South Africa in terms of health indicators, with the results compared to the region of Sub-Saharan African.

However, to construct the models in accordance with the proposed methods in SNA 2008 a completely different data material is required than what is available at present. In the optimal scenario case-mix based data would exist. As a consequence of this the models presented are a result of the reliable data that is available.

4.1. South Africa's government sector

The first distinction that needs to be done in order to understand what government services is in South Africa is that the public sector is different from government services. The difference and the relationship between the public and government sector will be shown with a figure later in this section. Initially the focus will be on the government sector, which is more specific.

The government organization in South Africa is divided into three different levels, *local, provincial* and *national* government. Each level of government has executive authority in their own sphere and is independent from each other. South Africa has nine provinces each with their own government and political party in power. (KwaZulu-Natal legislator, 2014) Figure 4-1 show the political structure of South Africa.

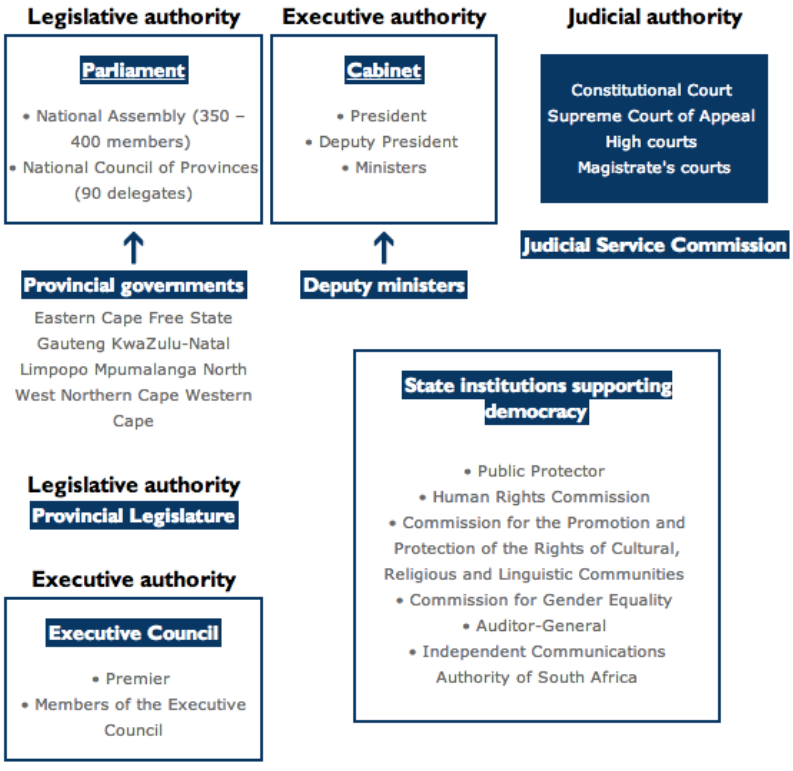


Figure 4-1: South africa government structure

In the government sector of South Africa there are three primary types of units, *core government units, social security funds,* and *other non-market nonprofit institutions* (NPI). Core government units are the institutions of the national, provincial and local government. The institutions of the local government are often referred to as *municipalities*. The social security funds that are controlled by the government are included in the government sector. The main ones are Unemployment Insurance Fund (UIF), Road Accident Fund (RAF) and similar funds to compensate employees in specific sectors. NPIs are units similar to corporations in the sense that they may own assets, incurring liabilities and engage in economic activities. NPIs could either be market producers or non-market producer, the definition of a market producer being a unit that

produces goods or services for sale at economically significant prices with intentions to cover costs. Not all NPIs that are controlled by the government are part of the government sector. In South Africa the South African Reserve Bank, SARB, is an exception. The general rule in South Africa for including NPIs into the government sector is if they meet the following two criteria. (Statistics South Africa, 2014)
-The entity charges economically significant prices for its output.
-The entity operates and is managed in a similar way to a corporation.

The most economically important NPIs that are part of the Government sector are public hospitals and schools, which are run independently but are controlled by the government or government units. As a result their account methods should follow the guidelines for this particular niche. These account guidelines are the same as for all NPIs controlled by the government in terms of measuring input, output and the economic value created by the unit.

4.1.1. The public sector

The public sector is a collaboration of the general government units and the public corporations. A public corporation is defined as a corporation that is a market producer and is controlled by another public unit. To be controlled by another unit means the significant unit has the ability to decide the policy and actions of the controlled unit. (SNA, 2008) The usual case is that public corporations are controlled directly by the general government. The general distinction for the public sector is shown in figure 4-1

<table>
<tr><th>Non-financial corporations</th><th>Financial corporations</th><th>General government</th><th>NPISHs</th><th>Households</th></tr>
<tr><td>Public</td><td>Public</td><td rowspan="2">Public</td><td rowspan="2">Private</td><td rowspan="2">Private</td></tr>
<tr><td>Private</td><td>Private</td></tr>
</table>

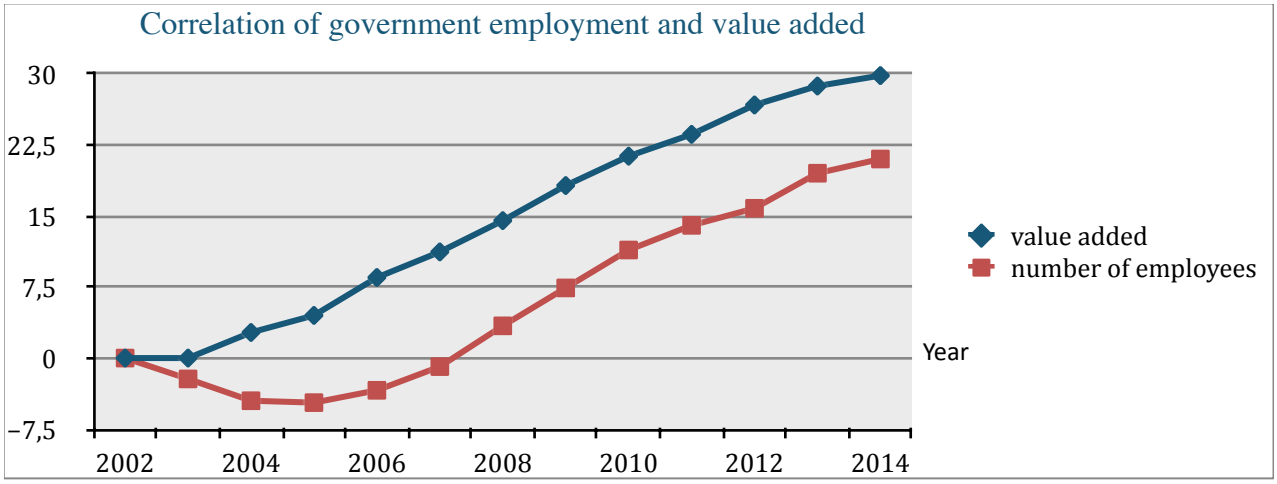
Figure 4-2: The public sector

4.2. Value added for government services

In South Africa the economic growth for government services at constant prices is calculated by SARB and published by Statistics South Africa. SARB officially states that this is done in accordance with SNA 1993 and that South Africa is in the process of adapting to SNA 2008, the most recent version of SNA. In SNA there is no exact definition on how to estimate output for government services, though there are guidelines. Neither SARB nor Statistics South Africa publicly declare which exact method is being used to estimate value added for government services. In neighboring countries the value added equals the expenditure for the government services minus intermediate consumption.

In reality this value added is dependent on the number of employees in the government sector. This is confirmed in an interview with the person compiling the national accounts for a number of

countries in Southern Africa.[3] There is reason to believe that South Africa use a similar method to calculate value added, and that there is a strong connection between value added for the government services, and the expenditure for workforce. Graph 4-1 display the value added for the government sector during the last decade, compared to the number of employees in government services.



Graph 4-1, correlation of employment and value added

As seen in graph 4-1 the correlation between the number of employees and the value added for government services is very strong. This suggests that South Africa alike neighboring countries uses some version of the cost method to calculate value added. As graph 4-1 indicates the number of employees and value added deviates the first years. There is no unique explanation to this, as it could be a consequence of poor data quality or that alternative methods were used then. However during the full decade the graph clearly indicates that the two lines show strong correlation, with the value added being a result of the number of employees.

4.3. Constructed models

This section presents the constructed models for measuring input, output and productivity together with the results from each model.

4.3.1. Criteria for data quality

In order to produce reliable results all data used in the models must to the furthest extent possible meet certain criteria for quality. The criteria that have been designated for all models are:
1. The data used in the model should be measured in a method that is consistent over time.
2. The data used in the model is if needed adjusted accordingly to allow comparison over time.
3. The data used in the model is trustworthy in the sense that it can be derived from multiple sources and is existent for an extensive time period.

4.4. Input public health

To produce healthcare a number of input resources are required. The three input categories that are used in this thesis are *technical, monetary* and *human resources* (HR). These are used due to their importance for service delivery. (Vujicic, 2009)

[3] Interview Jan Redeby

Monetary input serves as an enabler for technical input and HR, since these are dependent on capital. It is expressed in terms of expenditure at constant prices with base year 2010/2011.

Technical input data consist of resources such as infrastructure, hospital beds, surgery and diagnostic equipment. *Human resources, HR,* are the employed personnel. HR is important due to health care being a very labor intensive industry. This is confirmed in the expenditure for the public health sector, with compensation to employees being the largest categorical expense, as seen in graph 4-2.

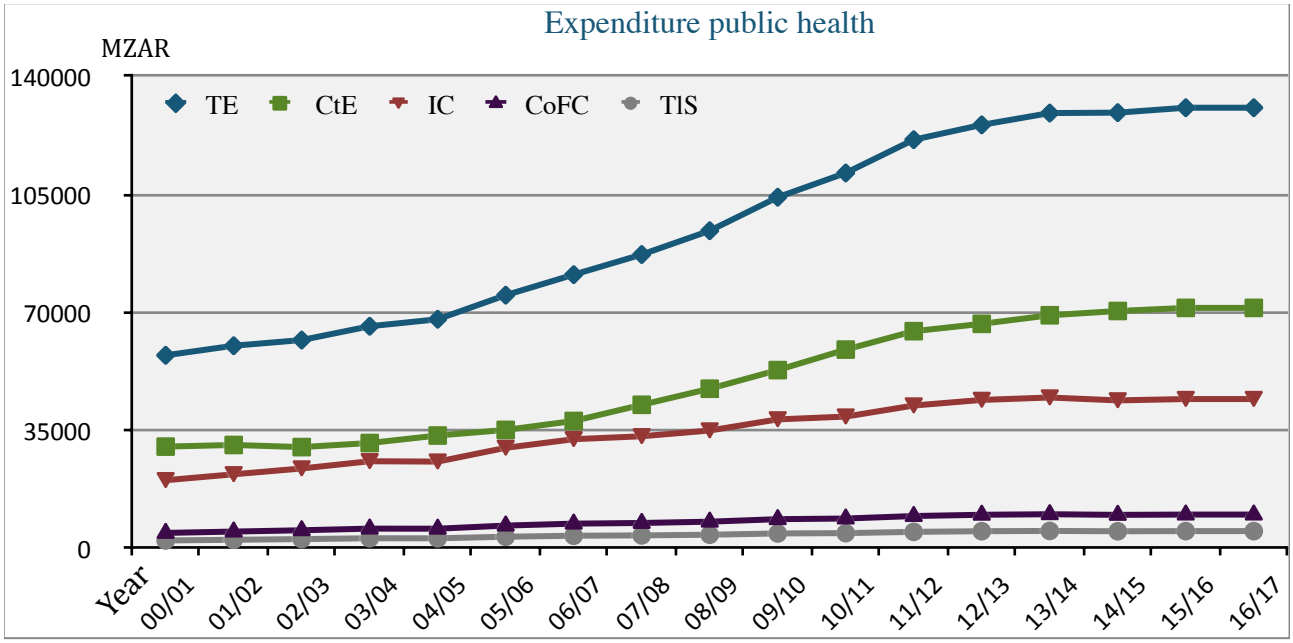
4.4.1. Monetary input

Monetary input is of importance due to a number of reasons. Monetary resources are required for the acquiring of other resources in the public health sector. As a consequence of the restricted supply of monetary resource it is a scarce resource. Therefore it is vital that the limited amount of capital decision-makers have at their disposal to spend on public health is spent adequately.

The monetary input in terms of expenditure for the public health sector is divided into four categories: (for further explanation, see section 3.5.)

- Intermediate consumption (IC)
- Compensation to employees (CtE)
- Consumption of fixed capital (CoFC)
- Other taxes (less subsidies) on production (TlS)

These categories are presented together with the total expenditure in graph 4-2.



Graph 4-2, Expenditure public health

Graph 4-2 presents the total expenditure for the public health sector from 2000/2001 up until 2016/2017. The data is gathered in 2013 and the data for the years from 2012/2013 and onwards are extracted from an unofficial national budget, acquired from the National Treasury.

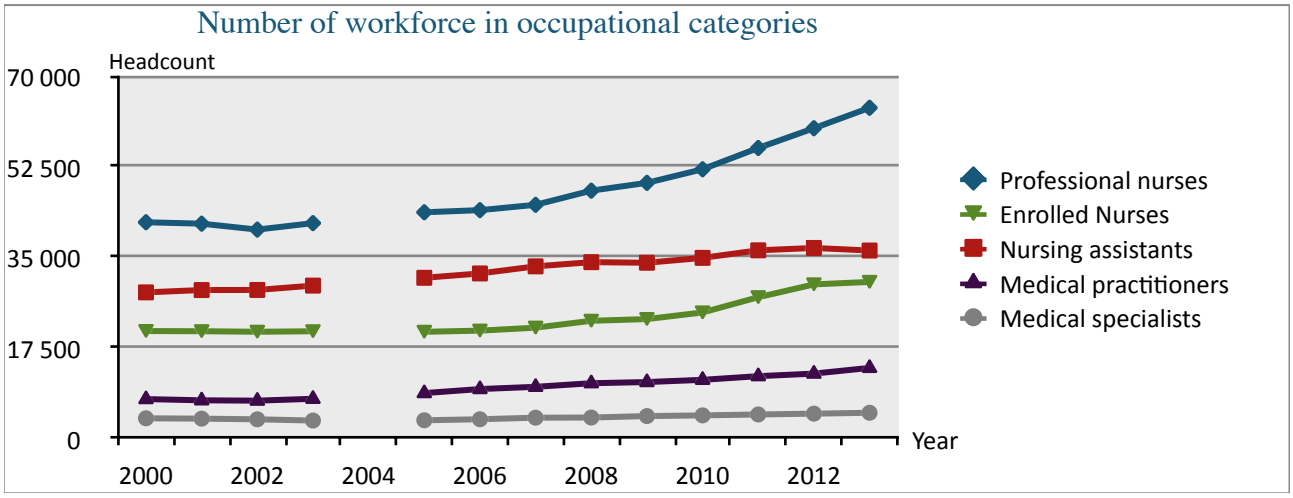
Graph 4-2 shows that the expenditure increases during the time period, in particular from 05/06 to 11/12. The increase over the total time period is 128 percent, giving an average yearly growth rate of 8.6 percent.

This is noteworthy since expenditure is the basis for calculating value added in government services using the cost method (see section 3.4.) This indicate that the economic growth of the public health sector of South Africa follow the same pattern and trend as TE line in graph 4-1.

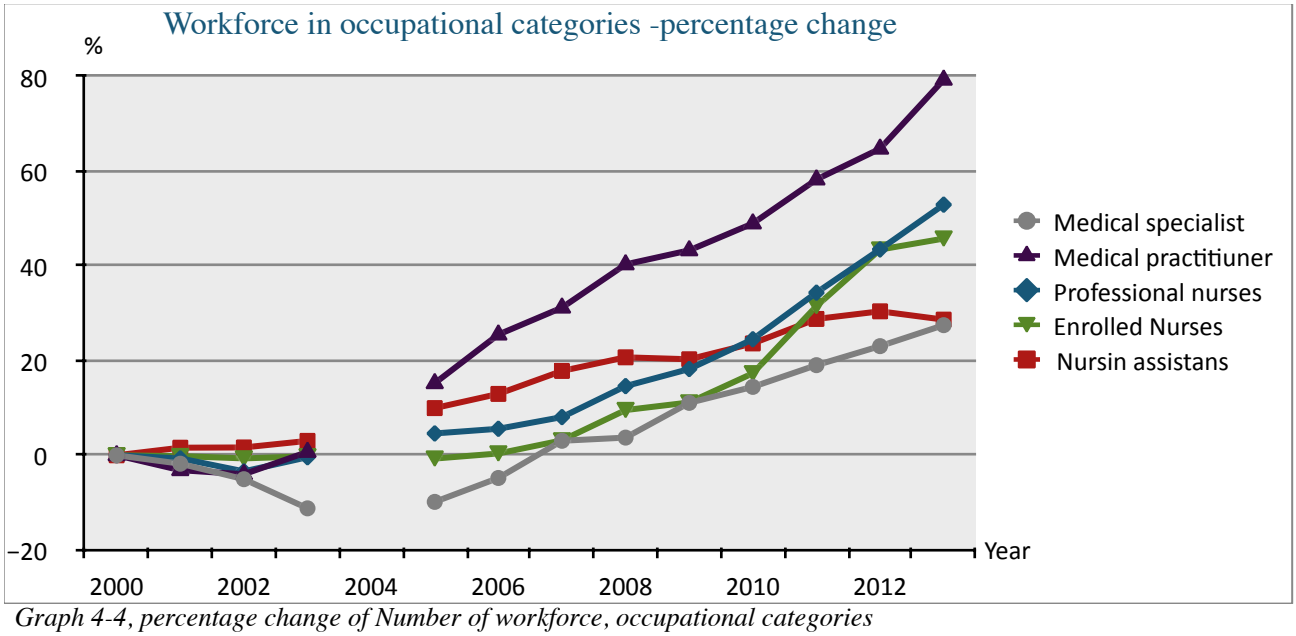
The economic growth for individual government services, such as the public health sector are not displayed in the national accounts for South Africa and cannot be used for comparison.

4.4.2. Human resource input

Human resource input measurement consist of measurements in number of personnel in key workforce categories. The input is divided into total number of workforce and number of personnel divided into occupational categories.



Graph 4-3, Number of workforce in occupational categories



Graph 4-4, percentage change of Number of workforce, occupational categories

Graph 4-3 show the absolute number of personnel divided into occupational categories during the time period 2000-2012. The data for 2004 does not exist. In a pattern that is similar to the expenditure, changes in workforce are minor until 2003, whereas increases in personnel are significant during 2005-2012. To better illustrate the changes graph 4-4 display annual changes in percent. As graph 4-4 shows, the number of medicinal practitioners have increased with approximately 80 percent during the time period, giving an average yearly growth of 6 percent per year. The growth trend for professional and enrolled nurses are similar, and the total number of nurses have increased with approximately 50 percent.

4.4.3. Technical input

The technical input for the public health sector is the number of public hospitals and the aggregated number of available hospital beds.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Public hospitals	375	399	412	382		396			401	410
Number of beds, (thousands)	106	106	100	88		89	90	89	87	

Table 4-1

This is a measure of the technical capacity of the public health sector. It reflects the supply of technical resources. As displayed in table 4-1, data for public hospitals is missing for 2005, 2007 and 2008. This is not an issue since the number is expected not to fluctuate in shorter time periods, since this requires the construction or shutdown of public health facilities, which is assumed does not occur in shorter timespans. As table 4-1 indicates the number of hospital beds show a declining trend. The number of beds decreases from 106,000 to 87,000 beds in the time period. This downward trend could have a number of possible explanations. The demand for hospital beds could have declined over the years as a consequence of that inpatient treatments take less time. That being the case this would appear in the measure of average length of stay per hospital visit, as the ALOS would decline together with the number of hospital beds. The number of hospitals has increased from 375 to 410 during the time period, giving a total increase of 9.3 percent.

4.4.4. Input shortcomings

The combined inputs of monetary, HR and technical resources aim to describe the reality of all inputs into the public health sector. This results in shortcomings. The HR input is measured in absolute numbers of key workforce, this results in that changes in the competence of the personnel will not be captured.

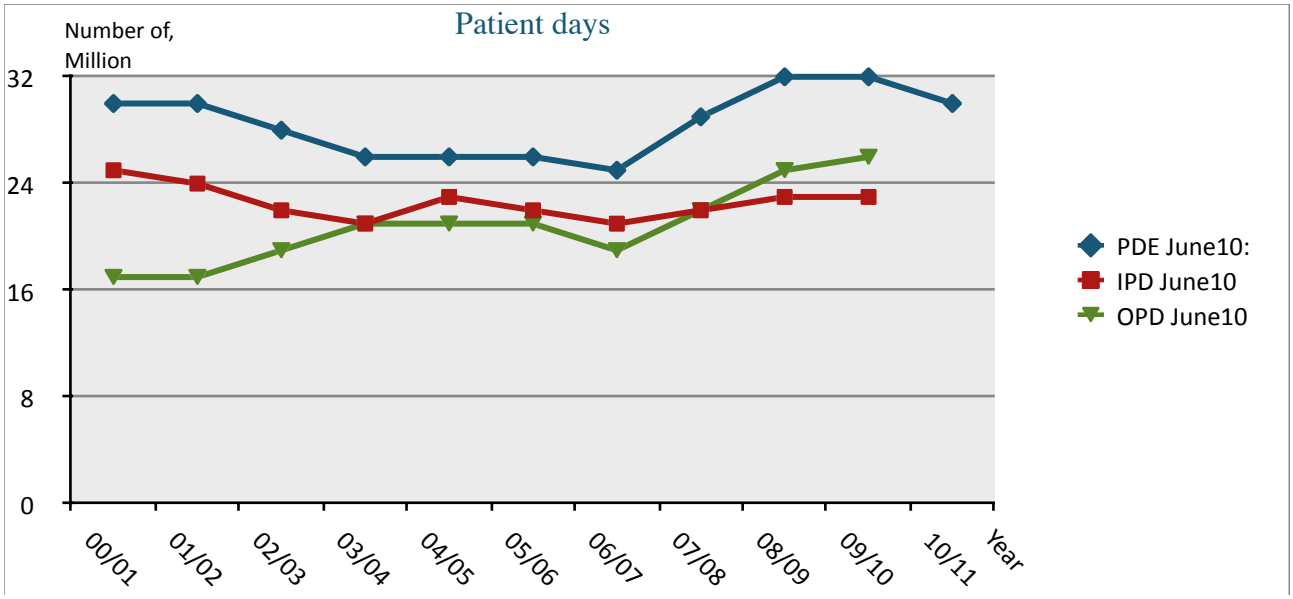
4.5. Output public health/PHC

There are different indicators for output in the public health care. This thesis uses PDE since this is the most extensive output measure available in South Africa. As a complement to PDE the number of PHC visits and number of separations are presented.

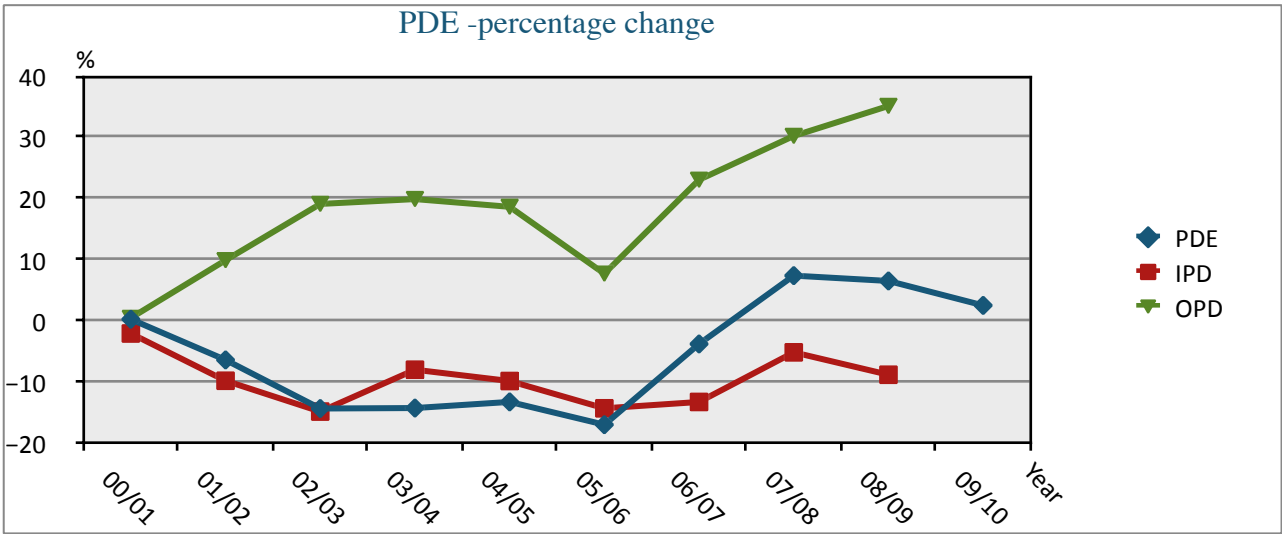
4.5.1. Patient day equivalent based

PDE (defined in section 3.5.) measures the absolute number of activities weighted according to the resources consumed, making PDE an adequate indicator for output. The PDE data in South Africa is acquired from National Treasury and has been measured for an extensive amount of time.

Graph 4-5 display the aggregated PDE, IPD and OPD, graph 4-6 show percentage changes.



Graph 4-5, patient days



Graf 4-6: percentage change, patient days

Data for the PDE is shown from 2000 to 2011 and the IPD and OPD until 2010. The data is obtained from the National Treasury where the IPD in graph 4-5 consist of inpatient days + 0.5 day patients. Apart from this alteration the components of the graph are in line with the definition of PDE established in section 3.5.

The major trends that are shown in graph 4-5 are made more distinct by graph 4-6, that shows percentage change in PDE, IPD and OPD with base year 2000. During the time period there has been a shift from inpatients to outpatients. Outpatient visits have increased with 35 percent since

2000 and in the same time period inpatient days increase with 6.5 percent (described in section 3.5.). This results in an increase of PDE with 2.5 percent over the same period.

4.5.2. Change in efficiency

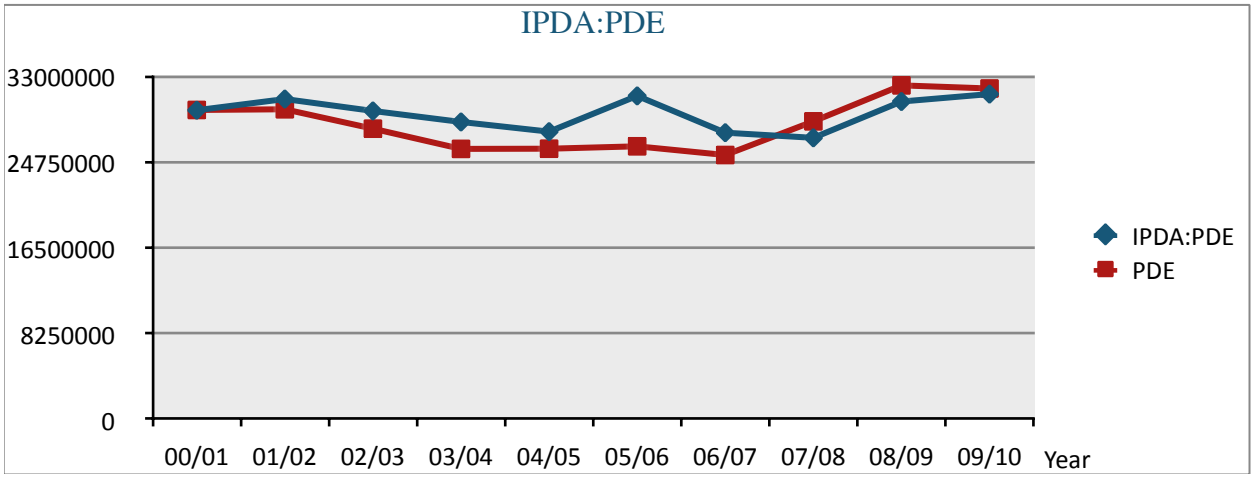
A flaw of PDE is that it does not consider changes in the efficiency of inpatient treatments. If the treatment of an inpatient changes, resulting in a longer or shorter length of stay. This is not captured in the PDE. This is illustrated with an example:

An inpatient *A* having diagnose *D* and the treatment of this diagnose takes *t* days, this results in a contribution to the total PDE of *t* in year *T*. In year *T+1* A more efficient treatment of diagnose *D* is found, which results in a treatment time of *t/2* days. The corresponding contribution to PDE is displayed in table 4-1

Year	T	T+1
Inpatient days contribution to PDE	t	t/2

Tabel 4-2: change in efficiency

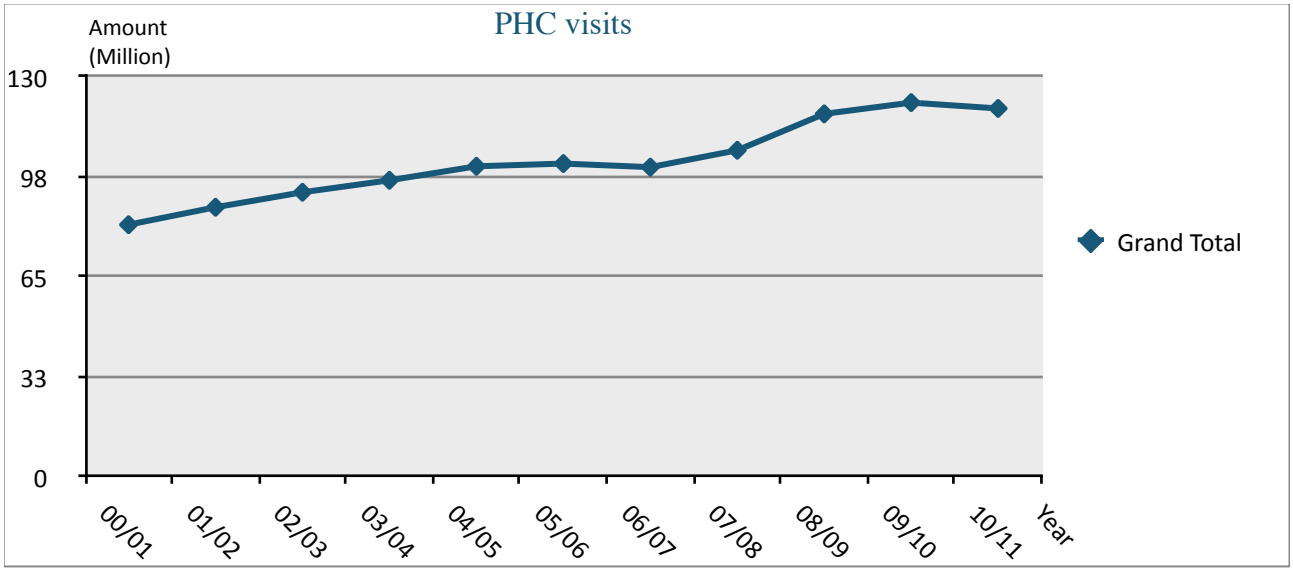
As can be seen the change in efficiency leads to a lower IPD despite the produced output being the same. This issue is resolved by constructing a new indicator, called IPDA:PDE, IPDA being an abbreviation for inpatient days adjusted. IPDA:PDE aims to adjust the PDE indicator for changes in efficiency which is done by adjusting the IPD component for changes in ALOS. Calculations for estimating IPDA:PDE can be found in appendix 3. IPDA:PDE can be seen as a complementing indicator to PDE for public health output. Graph 4-7 show the IPDA:PDE for the time period 2000/2001-2009/2010.



4.5.3. PHC visits and separations

PHC visits

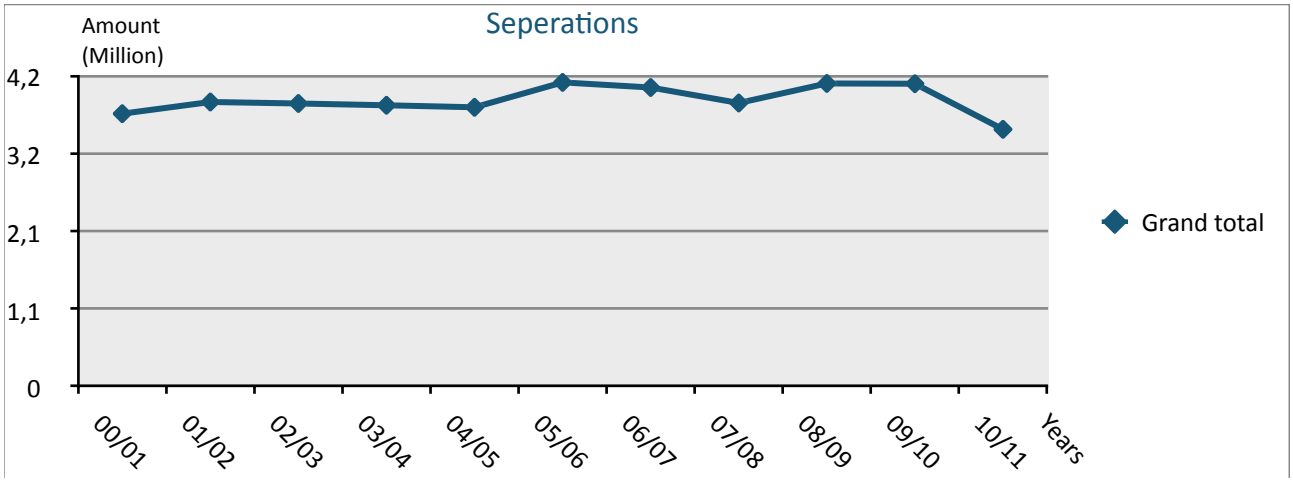
The total number of PHC visits was about 82 million in 2000/2001 and has grown to 120 million in 2010/2011. This is an equivalent growth of 46 percent.



Graph 5-8, Number of visits

Separations

The number of separations (see section 3.5. for definition) is displayed in graph 5-9. From 2000/2001 to 2009/2010 the number of separations has increased with 11 percent. From 2009/2010 to 2010/2011 a substantial decrease in the number of separations occurs, this decrease is partly because the data on number of separations is incomplete for 2011.



Graph 5-9: Number of separations

4.5.4. Shortcomings of PDE

Since PDE is the indicator used most extensive the shortcomings of PDE are discussed more in-depth, divided into four categories. These shortcomings are findings that were identified through the conduction of the thesis. PDE is used despite these shortcomings since it is the best data that exists for output in the public health sector of South Africa.

Case-mix
The PDE does not capture changes in the case-mix. This means that a treatment which is more resource intensive would be measured equally as one that uses less resources.

PDE weights
Weighting of the different categories of patient days and visits are used so the different categories can be compared and aggregated together and result in PDE. The weights that are applied on the different categories are designed to take the different amounts of resources used per day or visit for each category into account. Therefore, if the weights don't correspond correctly the PDE will be misleading.

Inpatient outpatient mix
PDE does not take changes in the inpatient and outpatient mix into account (driven by new treatment methods). Consider the following example: Patient A, with a certain diagnose D is in Year Y treated through admission as an inpatient to the hospital for X days and thereby contributes with $1 \times X$ to the total PDE. In Year Y+1 the same diagnose D can be treated without admission, for example through Z outpatient visits because, for example, improvements in medication. This results in the contribution to the PDE of $0.3 \times Z$. This is illustrated in Table 5-3.

Year	T	T+1
The contribution from Patient A to PDE	1X	0.3Z

Table 5-3, Inpatient Outpatient mix

If $0.3Z < X$ the measured output has declined

4.6. Productivity in public health sector

There is no formal definition or unique measure of how productivity and efficiency should be measured in the public health sector, though various different measures are used. Due to the context of development countries Zere (2000) and Mcintyre (2005) uses relative measures for productivity as stressed earlier.

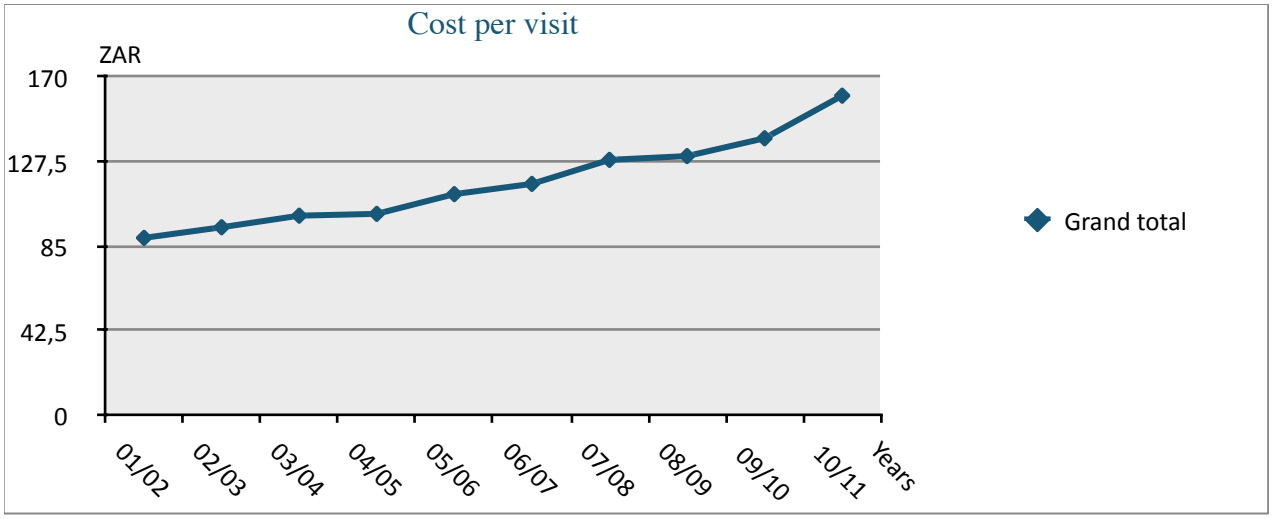
The methods introduced are based on the presented input and output indicators. Productivity estimates have been divided into direct and indirect measurements of productivity where the direct measurements follows the definition of productivity, e.g., by dividing input by output. (Slack, 2002) Indirect measures are used for indicators that are not comparable because they are expressed in different entities. Instead percentage changes is compared and used. This division into indirect and direct measurements is done due to the different nature of these indicators.

4.6.1. Direct productivity

Two different direct measurements are introduced and used, expressed in terms of expenditure per unit of output. These are cost per hospital visit and cost per PDE.

Cost per hospital visit

Expenditure per hospital visit is calculated as the public health expenditure at constant prices divided by the aggregated number of visits to public hospitals in South Africa. It is a fundamental indicator for productivity since it expresses the actual cost for the government per each hospital visit, commonly called cost per visit. Graph 4-10 shows the development of this indicator during 2001-2011.

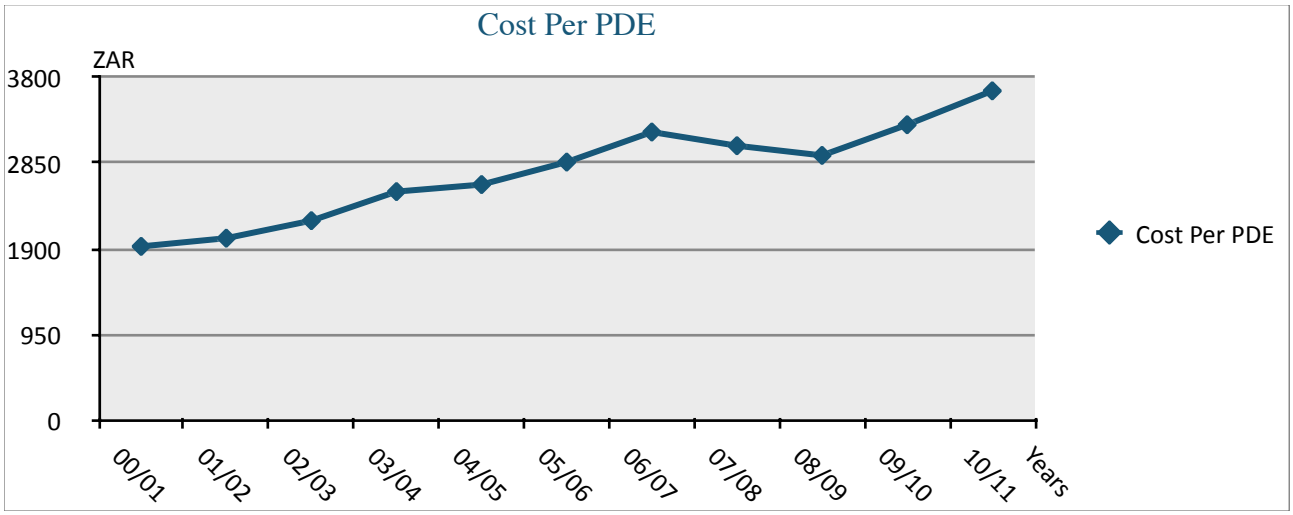


Graph 4-10: Cost per visit

As can be seen in graph 4-10 the cost per visit increase every year during the time period, summing up to an increase with 80 percent during these ten years. This is an alarming development for the South African government, particularly since it is adjusted for inflation. There are a two possible ways to explain this development. It could be a consequence of either the fact that costs are rising at a higher rate than the number of visits, or that the number of visits decline at a faster rate than the public expenditure. Earlier in this section the expenditure for the public health sector, and the number of visits to the PHC is presented. This gives the result that the rise in cost per visit is due to the increasing expenditure rather than changes in number of visits to PHC.

Cost per PDE

Cost per PDE is defined as the expenditure for the public sector at constant prices at year *t,* divided by the produced PDE year *t*. This created indicator called cost per PDE is an adequate productivity indicator measuring the cost efficiency per created PDE. Graph 4-11 displays the cost per PDE during 2000/2001-2010/2011.



Graph 4-11, Cost per PDE

As seen in graph 4-11 the cost per PDE is increasing during the time period, implying that the productivity of the public health sector is declining. From 2000/2001 to 2010/2011 the cost per PDE increases with 89 percent. This means that the cost efficiency of the South African public health sector (with PDE as output indicator) has been falling with an average of 8.9 percent per year in the given time period.

4.6.2. Indirect productivity

The indicator used for indirect productivity is the estimated key workforce productivity.

Measuring Workforce Productivity
In the South African public health care compensation to employees is the largest categorical expense, being 53 percent in 2012/2013. Consequently there is an interest in calculating the productivity of the workforce.

According to Vujicic (2009), there is no best-practice on how to measure productivity in the public health sector. It can be done through different methods such as measuring the level of absenteeism, the share time health workers spend on clinical care activates during working hours.

Vujicic (2009) defines productivity as the amount of output produced by a given input. From this definition he constructs a model that divides the aggregated health care service provided, into a Composite Service Index (CSI) and the aggregated relevant labor inputs, into composite human resources for health measure index (CHRH). Productivity is then calculated according to equation 4-1.

Equation 4-1: $\text{Productivity} = \frac{\text{CSI}}{\text{CHRH}}$

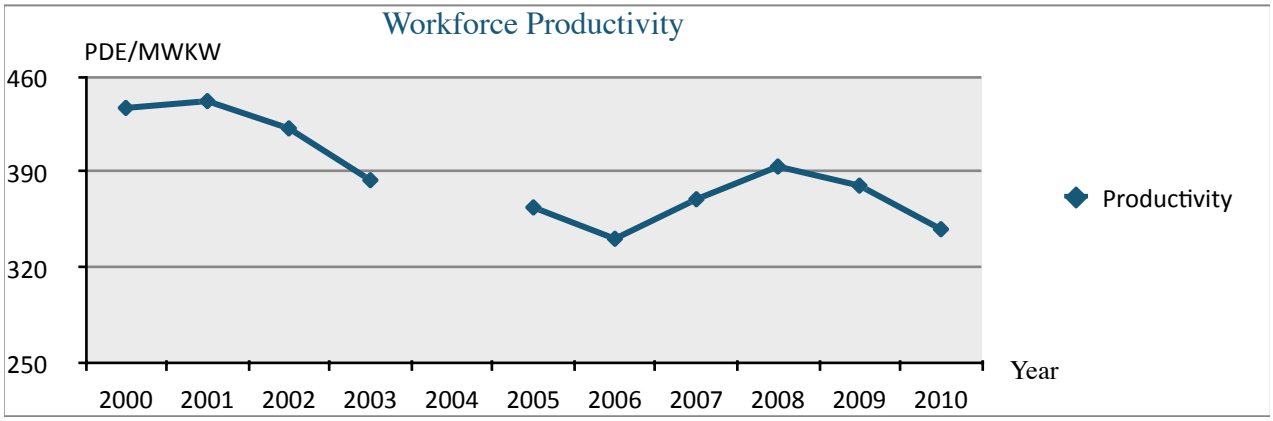
Here a method is used that is a slight alteration to the method constructed by Vujicic, who used it to measure the productivity of the health workforce in Ghana. This method is altered to be used with the data that is available for South Africa's public health sector.

The input data for CSI is PDE based, constructed from IPD and OPD which are weighted together according to an approximation of the resources consumed by the two different categories. Vuijicic (2009) states that PDE is a commonly used and comprehensive measure of health care service delivery.

The CHRH consists of data of the number of health workers from relevant health service categories. These different categories are weighted together according to the relative salary of each individual category compared to the average salary of all categories, see equation 4-1. The workforce productivity is displayed in graph 5-12.

Equation 4-2: $WKMW_y = \sum_{iy}(S_i / \sum_i S_i) \times N_{iy}$

With S_i = salary for category i, and N_{iy} = number of personal category i, year y



Graph 5-12: Workforce productivity

Graph 5-12 show that the workforce productivity has decreased during the time period 2000-2010 with 25.2 percent. The lowest productivity is shown to be in 2006 followed by a rise in productivity spiking in 2008 where after the productivity has decreased steadily until 2010.

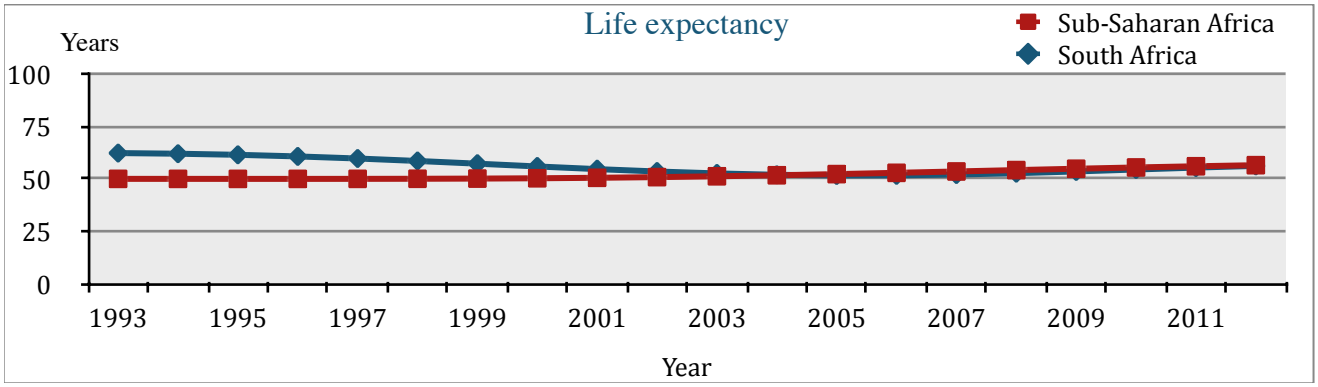
4.7. Indicator summary public health

To summarize and give an overview of the results and development of the input, output and productivity indicators during the time period 2000-2011 (to the extent that data is existent) these are presented in appendix 2.

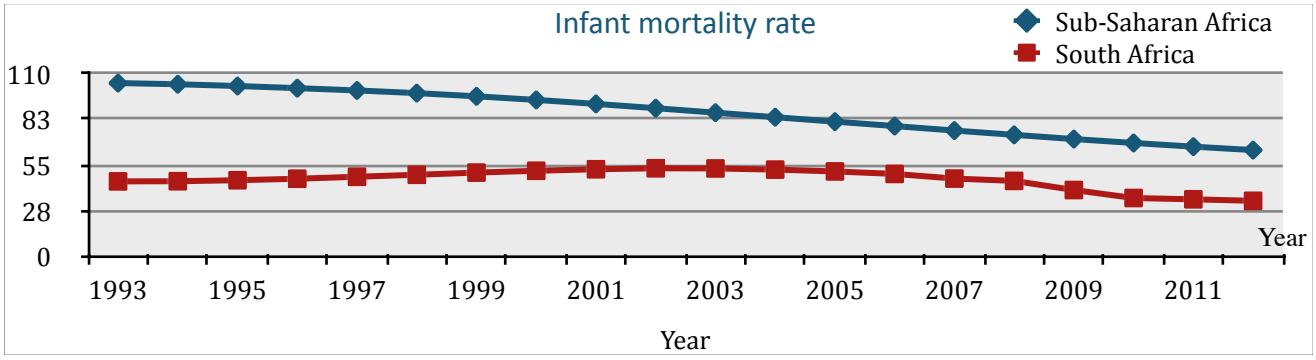
4.8. Health outcome South Africa

Health indicators are used to measure public health. These are created with the aim to study development in public health over time in a population and to compare different population. The European Commission has constructed a list of 88 indicators (European Commission, 2013) used to measure public health called the *European Community Health Indicators*, EHIC. The aim of the EHIC is to create comparable health indicators in order to measure public health.

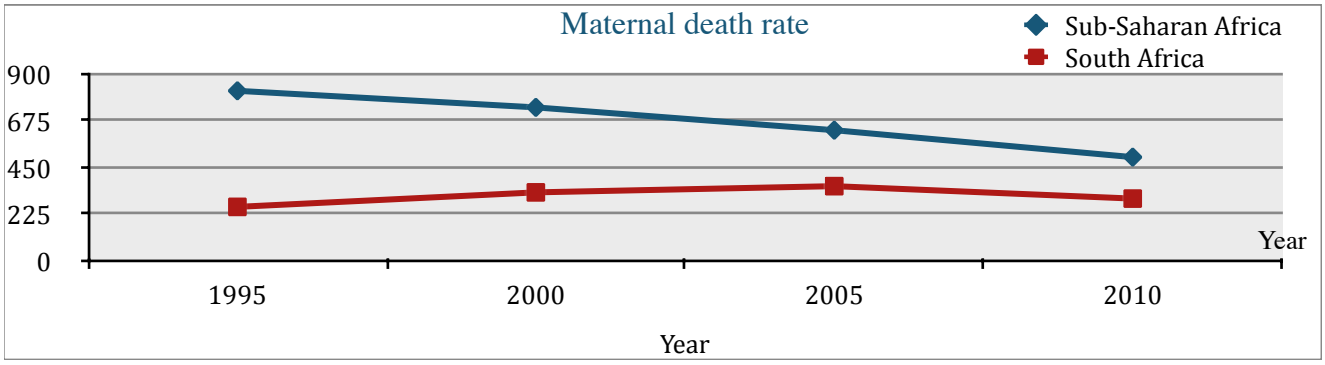
Since public health is affected by a variety of factors it is not possible to draw direct conclusions between public health and the performance of the public health sector. The performance of the public health sector is a measurement of the output, whereas the public health of the population is considered the outcome, as previously stated. The public health is a subject of other factors such as eating and exercising habits of the population. However, the performance of the public health sector naturally affects these health indicators, and their development over time gives an indication but not an absolute evaluation of the public health system. Therefore a review of the development of the most fundamental health indicators during 1993-2013 are shown in graph 4:13-15, where the performance of South Africa is compared to that of the neighboring region Sub-Saharan Africa. The chosen indicators were selected due to their importance and the existence of reliable and complete data.



Graph 4-13: Life expectancy



Graph 4-14: Infant mortality rate



Graph 4-15: Maternal death rate

Graph 4-13 show the expected number of years a number of years a newborn infant would live following national mortality patterns. As shown in the graph the life expectancy of South Africa is higher than in the rest of the Sub-Saharan region in 1993 but declines over the years and from 2003 and onwards the life expectancy of South Africa follow that of the Sub-Saharan region closely. There are more than one explanation to the reduced life expectancy in South Africa during the time period from 1993-2004, one being that incomplete data were being used for the early years. However, it is of interest to conclude that the life expectancy of South Africa has developed in the same way as in Sub-Saharan Africa during 2003-2011. The graphs showing the infant mortality rate and the maternal death rate display similar patterns. The performance of South Africa declines from the first decade of the measurement, and displays a similar development as the Sub-Saharan region for 2005-2010. The performance during the first decade is not unlikely a consequence of higher quality of the base data or a raised awareness of the issue, resulting in more accurate statistics.

These specific health indicators are closely linked to the public health sector. If the overall quality of the public health sector increased it would probably be noticed, particularly in the statistics of the infant mortality and maternal death rate.[4] Based on these statistics it can be concluded that during the time period 2003-2010 South Africa's performance in these public health indicators are closely linked to those of the neighboring region.

[4] Interview Weskoppies hospital

5. Value added public health and forecast

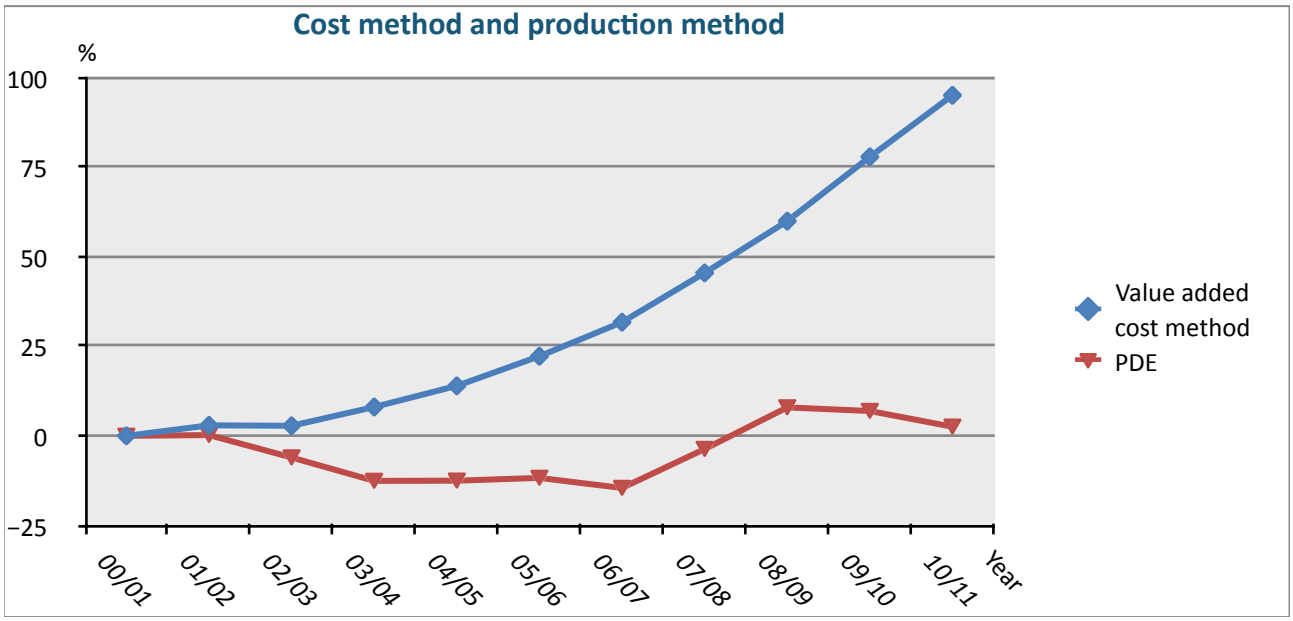
As a consequence of the indicators and data presented in section 4., the value added for the public health sector of South Africa can be estimated. This is divided into two parts, the first being the value added using the cost method which is used in South Africa at present and the second part using the production method which is based on changes in PDE.

5.1. Using cost method

The GDP and economic growth in the government services in South Africa is as previously stated calculated according to SNA'93 with a version of the cost method (see equation 3-1). The economic growth of the public health sector is in accordance to this 94.50 percent, or 9.45 percent per year.

5.2. Using production method

In contrast to the economic growth by the cost method, the model presented here aim to estimate the value added and economic growth according to the production method, as described in SNA'08 (See section 3.4.). The economic growth for the time period as calculated by the production method is the change in output during the time period. The change in output in terms of PDE during the time period is 2.50 percent, which is the economic growth during the time period, and gives a yearly average growth of 0.25 percent. Graph 5-1 show the comparison between value added for the cost method and the production method.



Graph 5-1: Cost method and production method

5.3. Forecast

This section gives a forecast of the monetary and HR input into the public health sector for the time period 2014-2025. There is also a forecast of the output in terms of PDE.

5.3.1. Forecast of input

To forecast the input an indirect approach is used based on the forecast of the workforce in the public health sector.

Long term forecast regarding workforce in the public health sector is presented by the National Health Department in the HRH Strategy (Human resources for South Africa, 2011). This strategy document presents the National Health Departments future human resources strategy containing the years 2012/2013 to 2016/2017. Some areas are described from 2012/2013 to 2024/2025, including a forecast on number of workforce in the primary health care. This forecast from 2011 to 2025 of key medical workforce categories can be seen in table 5-1.

The forecasted weighted key medical workforce, WKMW, is calculated to a large extent in the same way that the WKMW is ordinary calculated, according to equation 4-2. (described in section 4.6.2.) The variation from equation 4-2 in section 4.5.2. is that the HRH strategy forecast gives the total aggregated number of nurses, not divided into nursing categories. To calculate the average salary for the aggregated nurses, equation 5-1 is used. The calculations for WKMW are after that in line with equation 4-2.

Equation 5-1: $TotS_{avg} = \sum_{i} WN_{iavg} \times S_i$ For further explanation, see appendix 3.

There is a forecasted increase in all key workforce categories, i.e., medical practitioners, medical specialists and nurses. The forecasted growth a substantial total and annual growth of these workforce categories is stated.

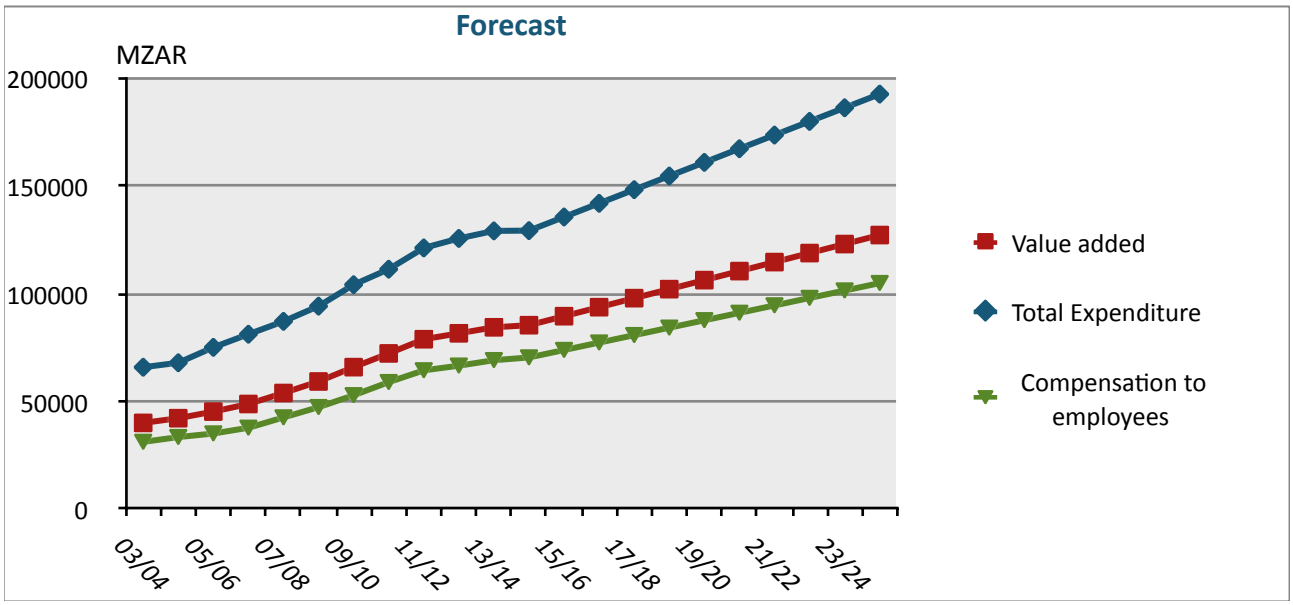
Workforce category	2014	2025	Growth(%)	Annual Growth(%)
Medical Specialists	8237	15818	92	8.37
Medical practitioners	14502	19894	37	3.38
Nurses	143063	203700	42	3.85
Wheigted Key workforce	79935	119107	49	4.5

Table 5-1: Workforce category

It should be taken into account that these numbers are the forecasted actual number of professionals working in the public health sector. The target set by HRH for almost all workforce categories are higher than the actual number of workforce, but due to a predicted shortage in workforce the forecasted actual number is lower than the forecasted target for almost all workforce categories. (Human resources for South Africa, 2011) If the workforce supply increases at a faster rate than predicted the forecasted number of workforce would therefore be adjusted accordingly.

From 2001/2011-2014/2015 the ratio of total expenditure and expenditure on workforce has been essentially constant. To forecast the total expenditure on public health until 2025 this relation is used. Based on these relations the total expenditure for public health is forecasted to grow with 4.5 percent between 2014 and 2025 shown in Graph 5-2.

Using the average ratio between intermediate consumption and the total expenditure the forecasted value added is then calculated with the cost method, shown in Graph 5-2



Graph 5-2: Forecast

Year	2014/2015	2024/2025
Total expenditure	129172	192467
Compensation to employees	70360	104837
Value added	85319	127125
Percentage change		49

Table 5-5: Workforce category

The forecast of expenditure based on the number of workforce is moderate. This is due to the presumption that the growth of workforce equals an equal amount of percentage growth of expenditure. Historically the annual average percentage growth of total expenditure is twelve percent larger than the annual percentage growth of WKMW, resulting in the annual average percentage growth of total expenditure historical being 235 percent larger the annual average percentage growth of WKMW. This due to the salary level has increased faster then the number of workforce.

This is not primary used in the forecast of total expenditure since no trustworthy forecast of changes in salary for the PHC could be obtained. The continuation of the historical trend is likely, but not certain due to the properties revolving decision for salary increases. But it should be taken into account that the forecast presented in graph 5-2 is likely an underestimation of the growth for total expenditure.

5.3.2. Forecast of output

It is difficult to forecast output to the same extent and depth as input since no data predictions of future output in terms of PDE. Forecasting of output is therefore done by analyzing previous data. The historical annual percentage change has been calculated and is used to forecast future output, by assuming the output growth rate will continue. If the average annual change in PDE between

2000/2001 and 2010/2011 is used to approximate the development of output from 2014/2015 until 2024/2025, this results in a total growth of 2.5 percent and an annual growth of 0.25 percent. Due to the heavy assumptions made to forecast the output the result will not be used to estimate value added with the production method.

Part IV: Analysis

The aim of the fourth part of the thesis is to analyze the findings presented in the third part. The consequences of the results are discussed and there is a suggestion for a generalization of the results.

6. Analysis of empirical results

In this section the empirical results presented in Section 5 are analyzed. This is initiated with shortcomings of cost method, followed by an economic and operational analysis of the findings.

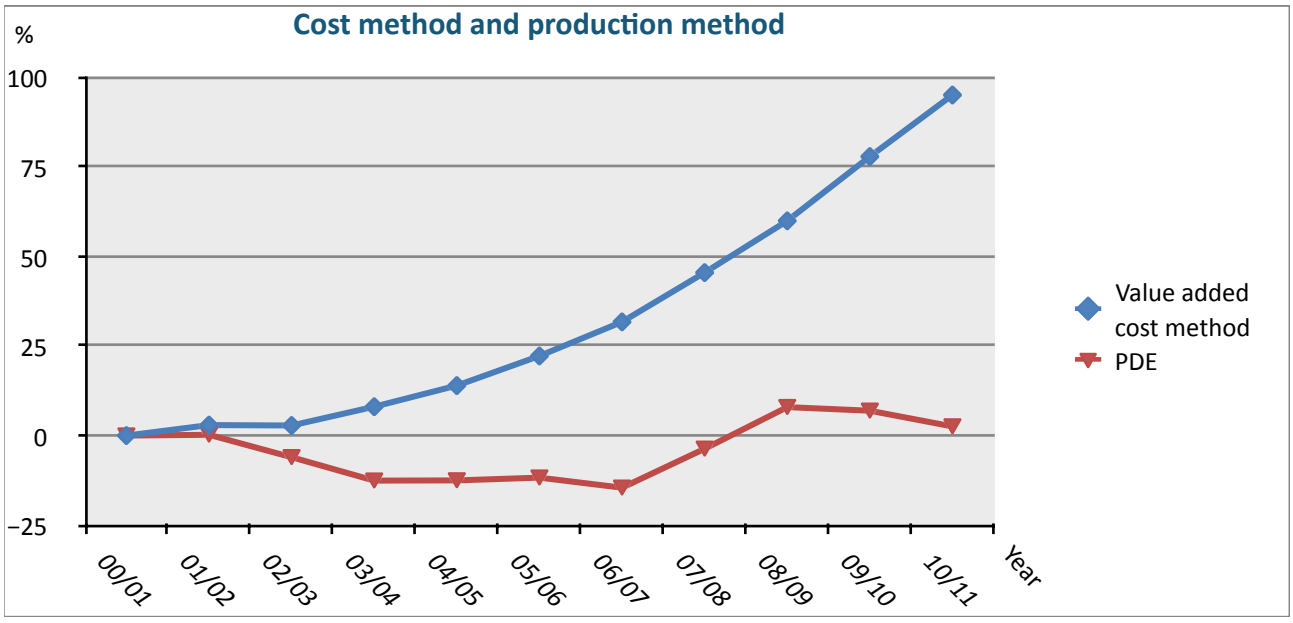
Shortcomings of the cost method

As described in section 3.4. the cost method calculates value from the input, and assumes a unit productivity. For the public health sector it has been stressed that value added equals the sum of expenditure minus intermediate consumption.

Since the productivity in the public health sector has declined during the reviewed period, this is an indication that the cost method is not suitable to calculate value added. Assuming that the absolute productivity is less than one, that is less than unit productivity, gives consequences. Since the findings suggest that the productivity has declined significantly during the time period it indicates that the absolute productivity is less than one.

This would imply that the value added as calculated by the cost method is overestimated, since the input/output ratio (productivity) is less than one, in contrast to the assumption made in the cost method. This is verified by the calculation of value added using the production method, which gives a significantly lower value added than as calculated by the cost method.

These two results confirm each other in the sense that they imply that the cost method is not a suitable method for the estimation of value added for government services. This is also shown in the SNA 2008 in the sense that the cost method is abandoned in order to be replaced by the production method. Graph 5-16 show the differences between the production method and the cost method.



Graph 5-16: Cost method and production method

6.1. Economic analysis

For the period examined, 2000 to 2011, the value added and economic growth calculated through the cost method and the production method differ significantly. Under this period, the estimated economic growth through the cost method is 94.5 percent in contrast to the estimation through the production method of 2.5 percent, as displayed in graph 5-16. To understand this difference it is important to know how the cost method and the production method are constructed. The cost method assumes a unit productivity to give accurate results, meaning it only measures the input into the public health sector. In contrary, the production method estimates the output of the same process to calculate value added (for further information see section 3.4.)

The reason for these differences lies in the properties of input and output. The input into the public health sector (as defined in section 4.3.) is dependent on political policy and budgeting. This results in that the political mandate directly changes the input. As a consequence input can be increased if it is politically mandated and enough resources for the increase are disposable. Output in the public health sector is on the contrary created through the treatment of patients, caused by the transformation of input resources. To increase output as a consequence of increased input, the input resources have to be utilized. To evaluate to what extent this is achieved percentage changes in input is compared to percentage changes in output.

In the case of South Africa's public health sector, the large differences in percentage change for input and output indicate that the growth of input resource does not generate an equivalent growth of output, thus the input recourses are not utilized to their full potential. This means that the marginal utility of the input is declining with increasing input.

6.1.1. Economic Consequences

As previously stated there is no unique method to measure output in the public health sector, however one method might be more suitable than another. Depending on if the cost method or production method is being used, the economic consequences and implications differ for South Africa.

Regarding the production method as more suitable and accurate for calculating value added and economic growth results in the conclusion that the historical economic growth and value added for the public health sector of South Africa has been overestimated since it has been calculated using a version of the cost method.

The findings are mainly based on indicators, it should be taken into account that these indicators ability to measure actual performance can deteriorate over time, described by van Thiel (2002).

6.2. Operational analysis

Operational analysis is the analysis of changes in productivity in the public health sector. The indicators suggest a decline in productivity during the measured time period. During the same time the public health sector has expanded in terms of input. This indicates diseconomies of scale, meaning that the marginal utility of the input is declining with increased input.

As stated by Macintyre (2005), assessing the productivity was complex since the preferred data did not exist. The existents of Case-mixed based data such as data from a DRG-system yields the potential for more extensive operational analysis (Socialstyrelsen, 2011)

As described in the economic analysis there is an increase of monetary input recourses between 2001 and 2011 that has not resulted in an equivalent growth of output. This implies that the monetary productivity, derived from the definition in section 3.7. has decreased between 2001 and 2011.

The other productivity indicators indicate a decrease in productivity, except for bed utilization rate. The cost per PDE and the cost per visit increased with 89 respectively 80 percent in the time period. The workforce productivity estimated by the provided PDE per unit of workforce has declined over the time period with 25.2 percent, and the bed utilization rate has increased with 12.3 percent. (see appendix 2)

6.2.1. Operational Consequences

A decline in productivity in combination with an increase in input indicate diseconomies of scale, which means that the next unit of input will generate less amount of output compared to the previous unit of input. This seems to have been the case for South Africa's public health sector between 2000 and 2011. This implies that the public health sector cannot utilize the input and create equal amounts of output.

The consequence of this is that if South Africa's public health sector expands to meet the health needs of South Africa's growing population and increase the quality of the healthcare, the effectiveness of these recourses will decrease, resulting in a higher input requirements.

6.3. Forecast analysis

The input into the public health sector is forecasted to grow with 4.9 percent annually until 2025 which corresponds to a total growth of 49 percent. The forecasted annual growth output during the same time period is 0.25 percent which corresponds to a total growth of 2.5 percent. This results in a forecasted cost per PDE of 4675 Rand. This indicates that the development of the public health sector regarding economic and operations will be similar to the historical development between 2000 and 2011.

6.3.1. Forecast consequences

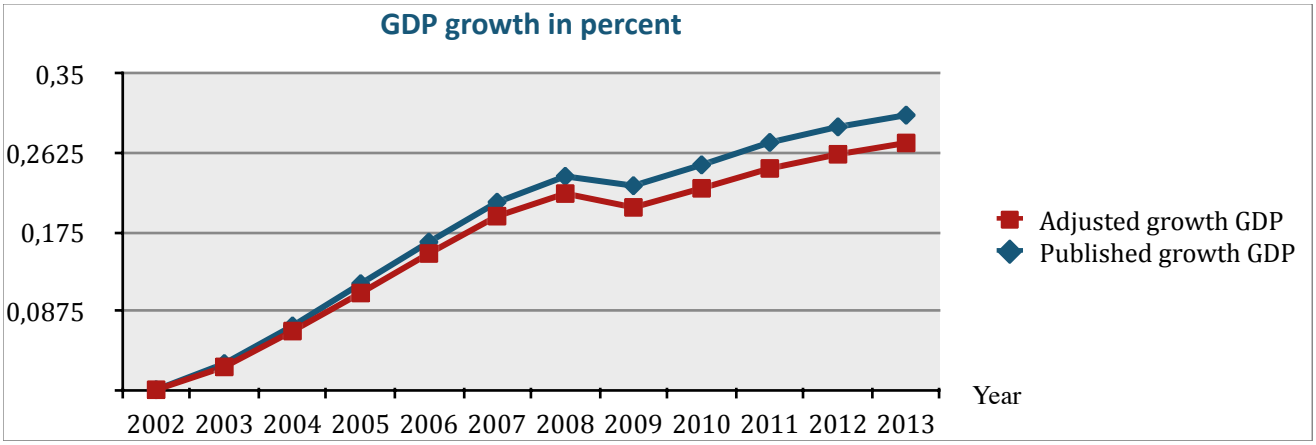
The forecast indicates that the economic and operational properties of the public health during 2001 to 2011 will continue until 2025 concluding that the economic and operational consequences South Africa face at present will continue, and possibly grow in magnitude.

6.4. Transferability of the result

In order to illustrate the results that are presented their transferability is examined. To do this, the findings of the growth rate of the public sector are generalized to include all government services. This is done to put them in perspective and make the results easier to relate to. To do this the economic growth in the public health sector as calculated by the production method is assumed to be equal for all government services, giving an economic growth rate for the total government services at 0.25 percent per year, during the time period 2001-2011. This is an assumption that has been made and might not be fully accurate. The official economic growth rate for the government services as published by Statistics South Africa (2014) during the time period 2002-2013 is 3.85 percent per year. This growth has been rather constant during the selected time period and as shown

previously the economic growth for government services is strongly correlated with the number of employees in the government sector, in accordance with the cost method.

Government services account for approximately 15 percent of the total GDP in South Africa, meaning that if the actual economic growth rate in the government services during this time period is 0.25 percent instead of 3.85, this would significantly affect the total GDP making it overestimated. Graph 6-1 shows the comparison between the GDP at constant prices accounted by Statistics South Africa, and the recalculated version where the economic growth rate in the government services is constant at 0.25 percent.



Graph 6-1: GDP growth

The adjusted GDP in graph 6-1 is found by removing the published value added by government services from the total GDP, and replacing that component with a constant growth of 0.25 percent per year. This results in an average yearly growth for the adjusted GDP of 3.4 percent, in comparison with the published growth rate at 4.0 percent. This might appear as a small deviation, however it needs to be stressed that this is yearly growth and for a time period of eleven years as the graph above displays, it makes a significant difference.

6.5. Consequences of an overestimated GDP

If the production method would give a better estimate for economic activity for the government services in South Africa it would indicate that GDP as published at present is overestimated. This would have financial implications for South Africa and also question whether the present economic growth rate can continue in the future.

6.5.1. Financial consequences

Assuming that the South African economic growth rate has been displayed as 0.6 percent higher than the real growth and that GDP is overestimated, this would have consequences for all economic indicators that are used in connection with GDP.

If the expenditure exceeds the revenues for an economy this creates a budget deficit. A government deficit would occur if a government were to spend more money than it receives in tax revenues, forcing the government to borrow money. A structural deficit is the definition of a budget deficit that persists over time. The structural deficit seen as the aggregated debt for a nation is expressed in terms of GDP. The estimations of the structural balance in South Africa is done by the National Treasury. It is calculated as the difference between ’potential’ revenue to GDP and the observed

expenditure to GDP, with the potential revenue being the observed revenue to GDP ran through a statistical filter[5]. Since the structural balance is expressed in terms of GDP an overestimation of the GDP would imply that the debt-to-GDP ratio is smaller than the published debt-to-GDP ratio. The debt-to-GDP ratio is an indicator for a nation's ability to pay off its debt and a high debt-to-GDP ratio lowers the credibility of the country. Significant overestimations of the economic growth over time in South Africa would therefor imply that the actual debt-to-GDP ratio is higher than it is displayed at present. This was confirmed by the fiscal department at the National Treasury at the workshop held there. " In the current environment, a lower level of GDP would mean a higher deficit as a share of GDP"[6]

As mentioned in the problem analysis GDP is very important for the fiscal policy, that is, the government's use of revenues and expenditure to influence the economy. Major fiscal variables such as government revenue, expenditure and budget balance are published as a share of GDP, concluding that a revision of GDP would affect these variables. There is a strong connection between the GDP at current prices and GDP at constant prices, and if real growth (growth in terms of constant prices) declines there is typically a fall in GDP at current prices. This indicates that an overestimation of the GDP at constant prices affect government decisions to influence GDP.

6.5.2. Sustainable economic growth

As stressed earlier the government services value added account for a significant part of total GDP. In order for the economic growth rate to continue in the future it is required that the growth from government services will continue, assuming all other economic growth to be constant. As shown in graph 4-1 the value added for government services is strongly correlated to the number of employees, since South Africa is using a version of the cost method to estimate value added for government services. This means that the government needs to continue to employ people in the same rate in the future in order to continue the economic growth. The last ten years the number of employees working in government services have increased from 1.1 million to 1.4 million, a rise with 0.3 million.[7] Given that the estimated population is approximately 53 million and the unemployment rate according to Statistics South Africa (2014) is 24.10 percent, it is unlikely that the government can continue to employ people at the same rate in the future. In the near future the employment rate ought to decline and possibly even come to a halt. This would mean that the economic growth rate for government services would follow, which would significantly affect the total economic growth rate as shown above. The conclusion of this is that the economic growth in the government services of South Africa is not sustainable, and there is reason to believe that it will decline in the near future. As a consequence neither the aggregated GDP growth can be viewed as sustainable, since it is largely affected by the value added of the government services.

6.5.3. Social and economic sustainability

Politicians and economic institutions of South Africa base their decisions on the information they have available. In the case of the public health sector the information is limited due to the oversimplified way used to measure economic growth and output in the public sector. Stressing shortcomings of the cost method gives a direct impact on the economic sustainability. For example

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[5] Interview National Treasury

[6] Workshop National Treasury

[7] Interview Statistics South Africa

by changing the knowledge of how funding within the health sector should be distributed, how the productivity is changing and how resources should be allocated.

It is vital for the social sustainability that basic government functions like the health sector work, this because treatment and medication is a necessity for the individual to live a long and prosperous life. A society is only as healthy and sustainable as the people that it consists of. In South Africa's case, to have a well functioning health sector it is important that it is efficient. As written in Hospital Efficiency in Sub-Saharan Africa, evidence from South Africa (Zere, 2000): "*Furthermore, given the economic reality of sub-Saharan African countries, the task of redressing inequalities in access to health care cannot be achieved without a concomitant improvement in efficiency. Inefficiency is more likely to breed further inequity.*"

6.6. Transition to a DRG-system

The potential transition for South Africa from the cost method used at present to a case-mix based system such as the DRG system is a complex task. There are several challenges to overcome before South Africa can have an operating case-mix measurement system. By observing other countries that have created and implemented a case-mix system, foremost a DRG system, conclusions on possible challenges South Africa will face in a transition are presented below.

6.6.1. Project length

The transition to a DRG-system or a measurement system of similar character has proven to take extensive amount of time, as read in the report Diagnose-Related Groups in Europe (European Obeservatory, 2011) *"...the European country experience is that this model takes time to implement well – typically 5–10 years, and it took even longer in the United States."*. Research findings have also indicated that the whole process of implementing the DRG in the entire public health sector can take longer than fifteen years.[8]

6.6.2. IT-infrastructure and database

A prerequisite for a case-mix based output measurement system to operate is well functioning IT-system and infrastructure that supports the amount of data that is needed to be collected, aggregated and processed. An initial step towards enhancing this would be to direct policies on data collection and processing, and to enhance the IT-systems in which the data is kept and processed.

6.6.3. Education

To enable the transition staff needs to be educated in the new policies and requirements of the new system. It is important that the staff that is involved in collecting the data is educated to determine and classify standardized diagnoses. The administrative staff need corresponding education for their tasks. This demands education and training of a number of personal in the public health sector.

6.6.4. Data classification

There are different forms of DRG system. In order to operate most of them requires that the following classification of data is done.

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[8] Interview National Treasury

- Classification of patients and diseases into categorized diagnosis such as ICD-10.
- Cost per treatment per individual diagnose.
- Diagnose related groups, classifying diagnoses that are similar in medical terms and the amount and type of consumed resources.

Due to the extensive time horizon of a DRG-system implementation, a transition should be divided into sub-projects. These sub-projects would be implemented in sequence, making it possible to reap the benefits from these before the full DRG-system is implemented.

Part: V Conclusions

The fifth part of the thesis introduces the key conclusions discussed in the analysis in order to answer the research questions.

7. Summary of the key findings

Here is a presentation of the key findings connected to the three main research questions of the thesis. (see section 1.4.)

7.1. Answers to research questions

Research question 1:

How is value added calculated for the public health sector at present in South Africa?

At present South Africa uses a version of the cost method defined in SNA'93 to calculate value added. This gives value added as the aggregated expenditure for the public health sector minus intermediate consumption. By using this method value added for the public health sector is strongly correlated to the number of employees in the public health sector, due to compensation to employees being the single largest expense for public health.

Research question 2:

How has the performance of the public health sector developed during the recent years in terms of productivity and output and what is the predicted forecast?

The output in terms of PDE has been rather constant during the time period, with a slight increase of 2.5 percent. All indicators for productivity imply that the productivity in the public health sector has declined. Forecast predicts that the current economical properties of the public health sector will continue.

Research question 3:

What are the effects if the recalculated value added for the public health sector is reviewed in a wider perspective to include all government services?

Generalizing the economic growth rate for the public health sector to include all government services suggests an annual average growth of 2.5 percent for all government services. Based on this premise the GDP of South Africa is overestimated and the actual GDP growth rate during 2001-2011 is 0.6 percent lower than the published. This implies direct consequences for the South African structural deficit.

7.2. Additional findings

Unexpected challenges were faced during the conduction of the research. The main challenge was to gather trustworthy data that existed for a satisfying time period. Further it was found that the communication between government authorities is a potential area of improvement. This was made distinct in tasks that were intra-organizational, meaning tasks that required the cooperation and exchange of information between different government organizations. This conclusion is shared by Mcintyre (2005) stating that the main problem with working in developing countries as the inefficiency in the government.

8. Further areas of study

This thesis aim to highlight different methods to calculate the economic growth for the government services in South Africa and to stress deviations in the result. This is done in a very simplistic way where the growth in the public health sector represents the growth for all government services. The public health sector account for approximately 13 percent of the total government expenditure and is one of the major components of the government services. In order to achieve more accurate results the study could be widened to include additional government components. The largest contributors to the government expenditure apart from the public health sector are the education sector and the South African police service. With models that calculated value added by the production method for public health, education and police service a substantial part of the government expenditure would be captured.

8.1. Education and police services

The first step to increase the scope of the study would be to include public education. To do that similar models as for the public health sector would be constructed to calculate output and value added for the public education in South Africa. The initial step to do this would be identifying indicators for input, output and outcome that could be used in the models. Indicators for outcome could be literacy rate, percentage of high school graduates and national test scores. Models to calculate value added could then be constructed according to the production method using adequate indicators for output.

Education would preferably be the first component to add to the study since at a first glance it appears to be easier to find suitable indicators than for the police services.[9] This is due to that there is a stronger correlation between the quality of education and outcome than for the quality of the police services and the outcome there. This conclusion was a result of the workshop held at the National Treasury.

8.2. Include Sub-Saharan Africa

The background making the study of interest is that there is no unique method to measure value added for government services, and that South Africa at present use a method in accordance with SNA 1993, a nearly 20 year old framework. These conditions to make the study interesting are satisfied in most of the countries neighboring South Africa. Similar studies could be made in neighboring countries and generate interesting results. A prerequisite to make such a study possible would be the availability of reliable data to create indicators for the government services, together with information about the method used at present to calculate value added for the government services.

[9] Workshop National Treasury

9. Final reflections and lessons learned

Working on the thesis has led to both personal and academic growth. On beforehand neither of the authors had any background in macroeconomics or macroeconomic variables. This resulted in a thorough study in macroeconomic in order to better understand the discipline.

It was interesting to work in South Africa due to the cultural differences to Sweden. The language barrier was not a problem but the cultural differences were distinct. This was rewarding for personal growth and development. As a cultural outsider one forces to adjust to social and professional norms which was enriching. South Africa does not have the freedom of information legislation that exists in Sweden. This was not initially taken into account by the authors and a conclusion is that the work would have been more efficient if such an act existed.

Throughout the thesis it was difficult to maintain a fully objective perspective and not take prejudices or personal opinions acquired during the project into account. This was done by actively learning about South African culture in order to better understand the political and cultural context and eliminate ambiguities.

It has been a true privilege to conduct this thesis. This is due to the authors' interest in South Africa and the unexplored field of study. Since this is a rather unexplored field the work has been slower than expected, but the results are more rewarding. It is an ambition that the results of the thesis will be considered and put to use, in order to give something back to everyone that has contributed with their time and input.

10. References

Alänge, S. (2014). 'Sustainability'. Available http://publications.lib.chalmers.se/publication/197071 [2014-05-05]

Björklund, M. & Paulsson, U. (2007). Seminarieboken – att skriva presentera och opponera. Lund: Studentlitteratur

Bryman, A. & Bell, E. (2007) Business research methods. Second edition. Oxford: Oxford University Press.

BusinessDictionary (2014). 'Economic sustainability'. Available http://www.businessdictionary.com/definition/economic-sustainability.html [2014-05-04]

BusinessDictionary (2014). 'Social sustainability'. Available http://www.businessdictionary.com/definition/social-sustainability.html [2014-05-04]

Brundtland (1987). 'Our common future' United Nations. Available http://conspect.nl/pdf/Our_Common_Future-Brundtland_Report_1987.pdf [2014-05-05]

Department of Health Australia (2014). 'Casemix funding history' Available http://www.health.vic.gov.au/abf/history.htm [2014-05-01]

Eklund, K. (2013) Vår ekonomi : En introduktion till samhällsekonomin. Sweden: Studentlitteratur AB

European Commission (2013). 'European Community Health Indicators'. Available http://ec.europa.eu/health/indicators/echi/index_en.htm [2014-04-02]

European Commission et. al. (1993). 'System of National Accounts (1993)'. A joint publication by the European Commission, IMF, OECD, and the United Nations.

European Commission et. al. (2008). 'System of National Accounts (2008)'. A joint publication by the European Commission, IMF, OECD, and the United Nations. New York:2009

European Observatory (2011). 'Diagnose-Related Groups in Europe'. Available http://www.euro.who.int/__data/assets/pdf_file/0004/162265/e96538.pdf [2014-03-04]

fDi newspaper (2013). 'African Countries of the Future 2013/14'. Available http://www.fdiintelligence.com/Locations/Middle-East-Africa/African-Countries-of-the-Future-2013-14 [2013-12-04]

Gillham, B. (2000). The research interview. London: Continuum International Publishing Group, 978-14-4116-023-2

Gimmel'farb, G. (2013). 'Recurrent Algoritms- Divide and conquer principle' Available https://www.cs.auckland.ac.nz/courses/compsci220s1c/lectures/2013S1C/Part1/220-06.pdf [2014-05-05]

Health Systems Trust (2014) 'Definition Average length of stay ALOS'. Available http://indicators.hst.org.za/healthstats/157/ [2014-03-05]

Healthlink (2011). 'Primary Health Care utilization rate' Available http://www.healthlink.org.za/uploads/files/dhb0809_35.pdf [2014-03-05]

Human resources for health South Africa (2011). 'HRH strategy for the Health Sector: 2012/13-2016/17'. Available http://www.gov.za/documents/download.php?f=152486 [2014-03-20]

KwaZulu-Natal legislator (2014). 'The structure of Government in the Republic of SA'. Available http://www.kznlegislature.gov.za/AboutLegislature/TheStructureofGovernmentintheRepublicofSA.aspx [2014-03-01]

Lennblad, A. (see appendix 2)

Mcintyre, D. (2005). 'Technical efficiency and productivity of public sector hospitals in three South African provinces'. Available http://onlinelibrary.wiley.com/doi/10.1111/j.1813-6982.2001.tb00016.x/abstract [2014-05-05]

NEPAD Planning and Coordinating Agency (2012) 'Africa decade of change', A joint publication of the NEPAD Planning and Coordinating Agency, the Economic Commission for Africa and the Office of the Special Advisor on Africa

Newman L (2013) 'What are Diagnose Related-Groups and why should you care?', Code of the month. Issue: January 2013. Available: http://www.generalsurgerynews.com/ViewArticle.aspx?d=Code%2Bof%2Bthe%2BMonth&d_id=65&i=January+2013&i_id=923&a_id=22374 [Accessed 2014-05-03]

OECD (2013), Health at a Glance 2013: OECD Indicators, OECD Publishing. http://dx.doi.org/10.1787/health_glance-2013-en [2014-03-02]

OECD, (2001). 'Measurement of aggregate and industry-level productivity growth'.

Patel, R. & Davidson, B. (2011). Forskningsmetodikens grunder. Upplaga 4:1. Lund: Studentlitteratur AB.

Roll, Y. (1993) 'Port performance comparison applying data envelopment analysis'. Maritime Policy & Management: The flagship journal of international shipping and port research. Available http://www.tandfonline.com/doi/abs/10.1080/03088839300000025#.U2ehk1fjKPo [2014-05-05]

SCB (2008). 'Volymberäkningar av offentlig individuell produktion -projektrapport' Available http://www.scb.se/statistik/NR/NR0102/EU-rapport%20NR-PM%202008-3%20(publicerad%202008-04-18).pdf [2013-12-23]

Schaay, N. Sanders D. (2008) 'International Perspective on Primary Health Care Over the Past 30 Years'. editors. South African Health Review 2008. Durban: Health Systems Trust; 2008.

Slack, N. (2010). Operations Management with MyOMLab. 6th Edition. ISBN-10: 0273731602

Socialstyrelsen (2011). 'Vad är DRG?' Available: http://www.socialstyrelsen.se/klassificeringochkoder/norddrg/Documents/Vad_ar_DRG_rev110617.pdf [2014-01-15]

Statistics South Africa (2013) 'Mid year population estimates', Statistical release P0302
The World Bank (2014). 'World development indicators' . Available: http://databank.worldbank.org/data/views/reports/tableview.aspx [2014-02-20].

Statistics South Africa (2014). 'Statistic of the non-profit sector for South Africa, 2011'. Discussion document: D0407.2

Van Thiel, S. (2002). 'The performance paradox in the public sector'. Available http://www.alnap.org/resource10508

Vujicic, M. (2009). 'Measuring Health Workforce Productivity: Application of a Simple Methodology in Ghana'. Available http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1095698140167/MeasuringHlthWorkforce.pdf [2014-02-20]

Wiley, M. (2014). 'Diagnosed-Related Groups in Europe'. Open University Press: England

Zere, E. (2000). 'Hospital efficiency in Sub-Saharan Africa: Evidence from South Africa'. ISBN 952-455-064-4

Figures

Part: VI Appendix

The sixth part of the thesis aim to present additional information that is relevant to the thesis but is not presented throughout the text.

Appendix 1: Contact person

Anna Lennblad

The contact person in South Africa for this thesis is Anna Lennblad. Anna lives nearby Pretoria, the capital of South Africa. She is born and grew up in Gothenburg in Sweden but for the last decade she has been living in South Africa. She has a Ph.D. in International economics from The Graduate Institute of Geneva, Switzerland. After her Ph.D. she worked as an economist for the IMF (International Money Fund) and as the Director of Research and Statistics at the Central Bank of the Seychelles. For the last decades Anna has been working as an independent consultant in development countries in Africa, the Middle East, Central Asia and Far East Asia. Her field of work includes doing the national accounts, financial forecasting, assisting statistical offices and central banks, and providing guidance to ministries of finance .Anna has been doing an excessive amount of work for the ministry of finance in South Africa and the SARB. Therefore she has good connections within many of the ministries and statistical institutions of South Africa. Due to her education and working experience Anna will have a good understanding of the study and will be of great advice. Further she can provide contact with people that are of relevance to the study at the SARB and the government ministries. She will also be helpful in understanding the national accounts of South Africa. Anna is currently writing a book that is to be course material for a course in macroeconomics at the University of Pretoria

Appendix 2: Raw data

Historical Expenditure on TE and CoE, forecast From National Treasury

Year	*TE*	*CoE*
00/01	57224,4775	20187,4154
01/02	60063,1855	21941,7875
02/03	61743,144	23664,5138
03/04	65833,3393	25813,4088
04/05	67907,0751	25703,2022
05/06	75054,9515	29790,1595
06/07	81133,5451	32345,9914
07/08	87099,312	33219,5707
08/09	94158,7461	34928,6755
09/10	104096,272	38221,6674
10/11	111288,261	39052,3422
11/12	121149,04	42333,1353
12/13	125549,221	43991,3712
13/14	129049,123	44706,0529
14/15	129172,355	43853,4043
15/16	130630,753	44254,7643
16/17	130630,753	44254,7643

PDE fromNational Treasury

	Patient days		
Year	PDE	IPD	OPD
00/01	29736605,8	24562584,9	17163949,1
01/02	29801850,1	24055410,2	17239319,7
02/03	27940011,4	22362939,6	19043885,4
03/04	25999095,1	21381829	21210595
04/05	26016313,3	22736562	21420450
05/06	26247080,4	22354005	21087739
06/07	25411032,6	21481548	18590135
07/08	28642681,6	21678572	22299249
08/09	32097713,3	23350513,6	24589670
09/10	31798247,8	22564782,5	26446220,3
10/11	30494341,1		

PCH visits from National Treasury, KMW - HRH Strategy document

Year	PHC visits	Cost per visit	Seperations
00/01	81907093,2		3693950,061
01/02	87571063	89,1080707	3852003,745
02/03	92438180,4	94,45068859	3831738,302
03/04	96330998	100,2743435	3807497,362
04/05	100874486	101,185466	3780357
05/06	101758377	111,1099977	4116851
06/07	100595221	116,2614752	4047626
07/08	106078145	128,34385	3838506
08/09	117902636	130,2462562	4102501
09/10	121562061	139,2045297	4098674
10/11	119662890	160,6219953	3482583

KMW Expenditure	
Medical practitioners	9294131808
Medical specialists	4748741068
Nursing assistants	4525970064
Professional nurse	21769124619
Enrolled nurses	4396470650

Number of KMW	
Medical practitioners	11664
Medical specialists	4513
Nursing assistants	35376
Professional nurse	55309
Enrolled nurses	26338

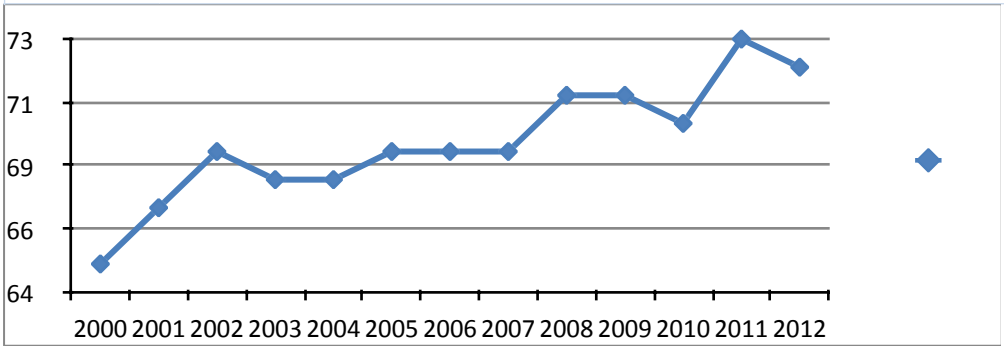
Input			
Year (base year 2000/2001)	2002/2003	2006/2007	2010/2011
Total Expenditure	7,9	41,8	94,5
Year	2002	2006	2010
WKMW	-5,1	-4,8	14,5
Year (base year 2001)	2002	2006	2009
Number of Hospitals	6,4	5,6	6,9
Number of beds	−0,3	−15,8	−18,2
Output			
Year (base year 2000/2001)	2002/2003	2006/2007	2010/2011
PHC visits	12,9	24,2	46,1
Separations	3,7	9,6	−5,7
PDE	−6	−14,5	2,5
IPDA:PDE			
ALOS	−12,2	−20,2	−17,2
Productivity			
Year (Base year 2000/2001)	2002/2003	2006/2007	2010/2011
Cost per visit (bas year 01/02)	6	30,5	80,3
Cost per PDE	14,8	65,9	89,6
Year (base year 2000)	2002	2006	2010
Bed utilization rate	4,6	6,1	7,7
Workforce Productivity			

Table 5-4: Summery of indicators

Bed utilization rate

The bed utilization rate is continuing has grown with 12 percent between 2000 and 2011, indicating an increasing utilization of the technical input.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
BUR	65	67	69	68	68	69	69	69	71	71	70	73	72



Workforce from National Treasury

Number of workforce					
Year	*Medical Specialist*	*Medical Practitioner*	*Professional Nurse*	*Enrolled Nurse*	*Nursing Assistant*
2000	3881	7591	28194	41734	20726
2001	3812	7352	28646	41460	20691
2002	3685	7287	28661	40318	20590
2003	3446	7645	29052	41563	20683
2004					
2005	3499	8747	31006	43660	20582
2006	3695	9527	31850	44071	20806
2007	4000	9959	33219	45102	21379
2008	4026	10653	34030	47834	22707
2009	4311	10878	33914	49341	23039
2010	4442	11309	34858	51966	24316
2011	4620	12014	36315	56075	27256
2012	4776	12508	36770	59890	29735
2013	4948	13614	36275	63833	30215

From Statistics South Africa

Government services		
Year	Number of employees (M)	Value added
2001	1,1	190910
2002	1,0758	190910
2003	1,0527	196193
2004	1,0505	199947
2005	1,0637	208561
2006	1,0901	214947
2007	1,1385	223284
2008	1,188	233416
2009	1,2419	242542
2010	1,2793	250014
2011	1,3057	260494
2012	1,3662	267714
2013	1,3926	271844

Expenditure budget, public health, 2010/2011-2016/2017

Year	Expenditure	Exp	Exp	Exp	Exp
	Tot	CoE	CoG	TaS	Capex
2010/11	97892,199	58906,783	28647,081	3506,672	6831,663
2011/12	111258,797	67834,664	31726,7081	3500,981	8196,44382
2012/13	122466,324	74212,3698	35107,2085	4734,3037	8412,44234
2013/14	133798,381	82741,3783	37612,8938	4558,425	8885,684
2014/15	139660,326	89199,7758	38329,4235	4140,77984	7990,34654
2015/16	149184,936	95633,0543	41234,4448	4282,00649	8035,42994
2016/17	156694,558	100385,606	43077,7975	4484,58294	8746,57122

Appendix 3: Calculation

PDE:IPDA
Equation PDE:IPDA(Y)= IPD(Y)*IALOS(Y)*W1+OPD(Y)*W2

IPD(Y): Number of inpatient days year Y
IALOS(Y): ALOS index year Y
OPD(Y): Number of outpatients and emergency room visits year Y
W1: Weight inpatient days
W2: Weight outpatients days

ALOS Index (IALOS)
Deflating the IPD for changes in effectiveness is done through the IALOS, the IALOS is calculated through equation 1. This masseurs the calculates the change in ALOS of two of each following years.

Equation 1: IALOS = (ALOS(Y+1)-ALOS(Y)/ALOS(Y+1))

Equation 5-1, explanation
-TotSavg = the weighted average salary of the nurses.
-WNiavg = The weighted number of nurses in group i.
-Si = The salary of group i.

Appendix 4: Workshop presentation

Agenda

-SNA'93
-SNA'08
-Value added for government sector and number of employees
-Output indicators public health
-Public health expenditure
-Actual GDP growth and adjusted GDP growth
-Output for health used in OECD

Cost based method -SNA'93

- The output is calculated as a comprising of:

- +Compensation and allowances paid to government employees
- +Compensation of goods and capital
- +Consumption of goods and capital
- +Consumption of fixed capital
- -Value of goods and services sold by general government

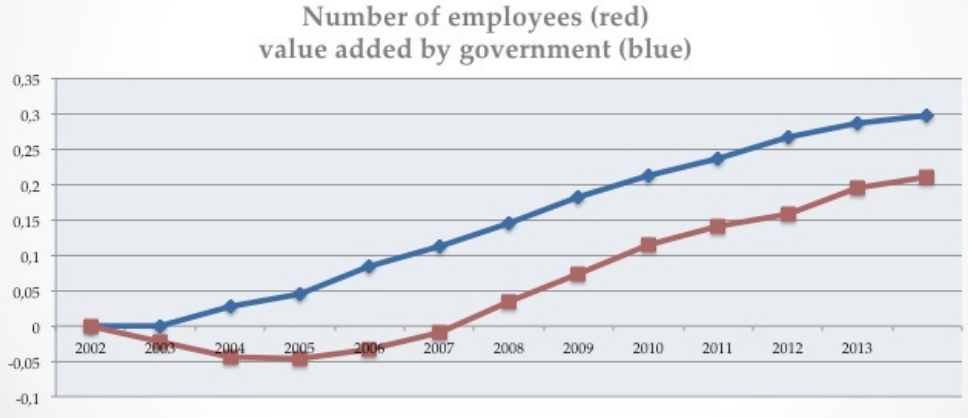
Production method -SNA'08

- The value added is based on the volume produced, given by volume indicators

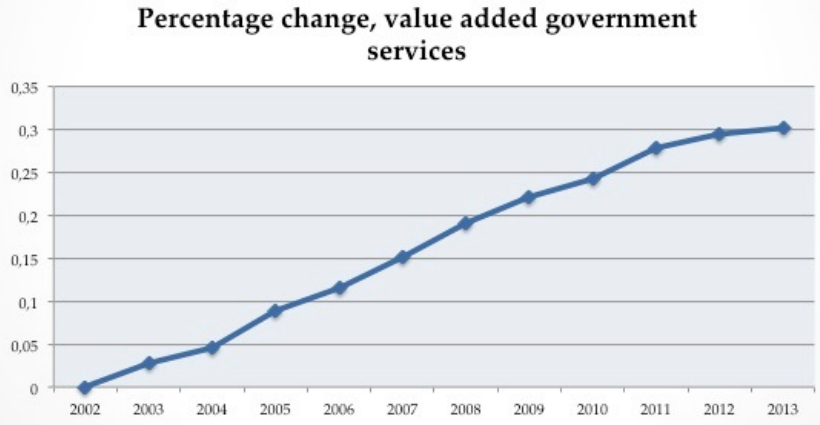
- A – Methods are preferred
- B – Methods are accepted
- C – Methods are not accepted

- Cost based method is a C method, which is not recommended by SNA'08

Government value added and employees



Value added government



Output indicators Public health

- Indicator: Patient day equivalent (PDE)
- PDE measures the volume of patients but because not all patients spend a full day all visits are dived into day patients, outpatients, and emergency room visits.
- PDE=1*inpatient days+0,5*day patients +0,3*outpatient and emergency room visits

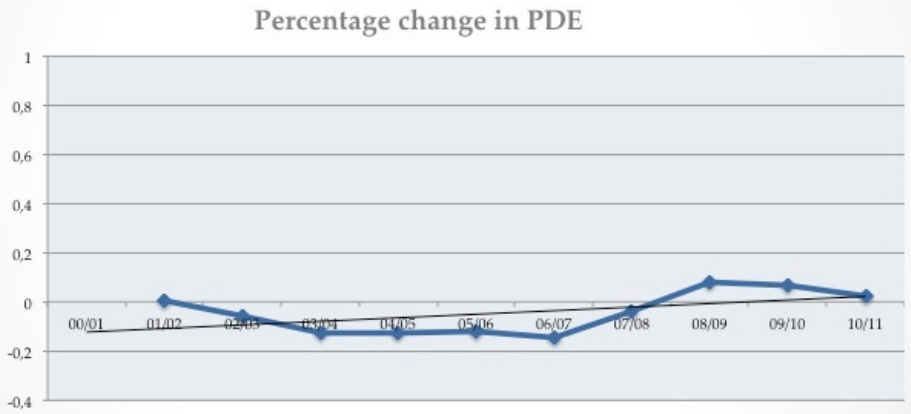
Public health -Output and outcome

- There is a difference in output and outcome
- -Output is defined in PDE
- -Outcome is defined as the quality of the service received

- The following data is based only on output, not on outcome

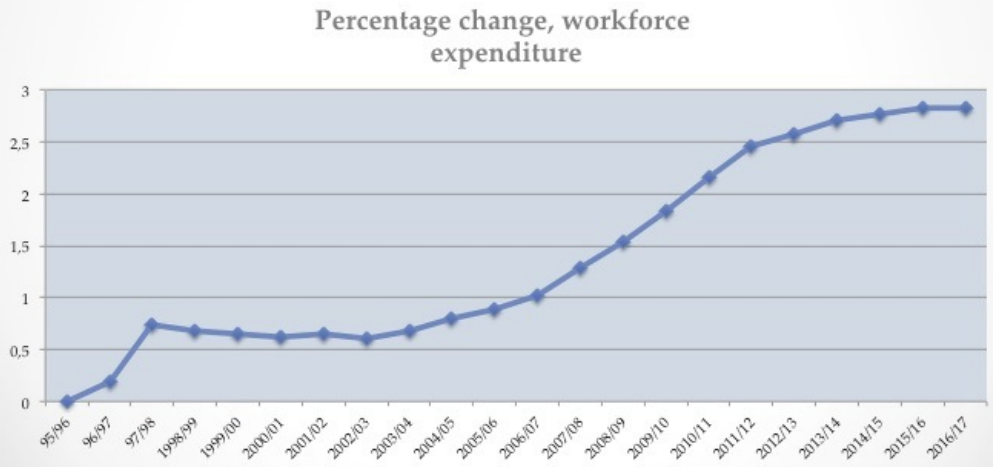
Output public health

Percentage change in output

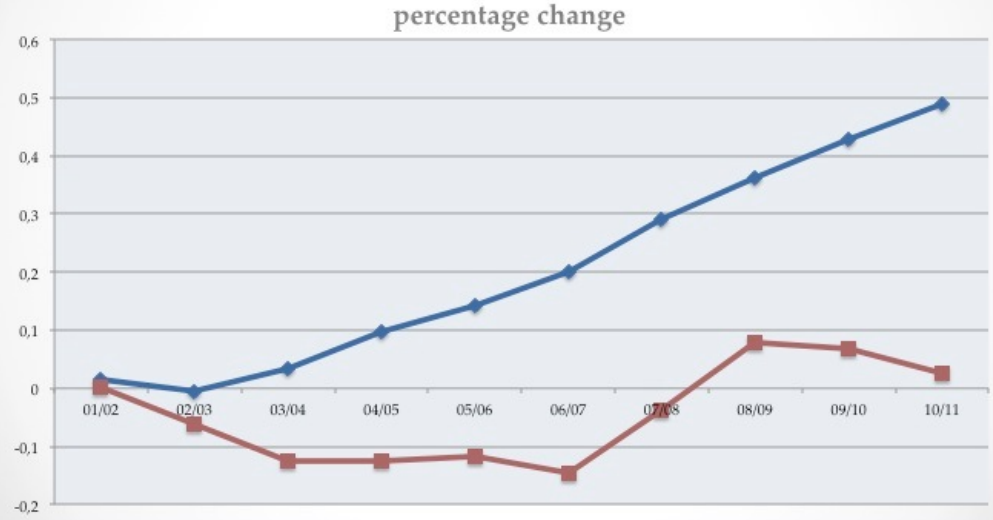


Public health expenditure –current and future

Public health expenditure –current and future

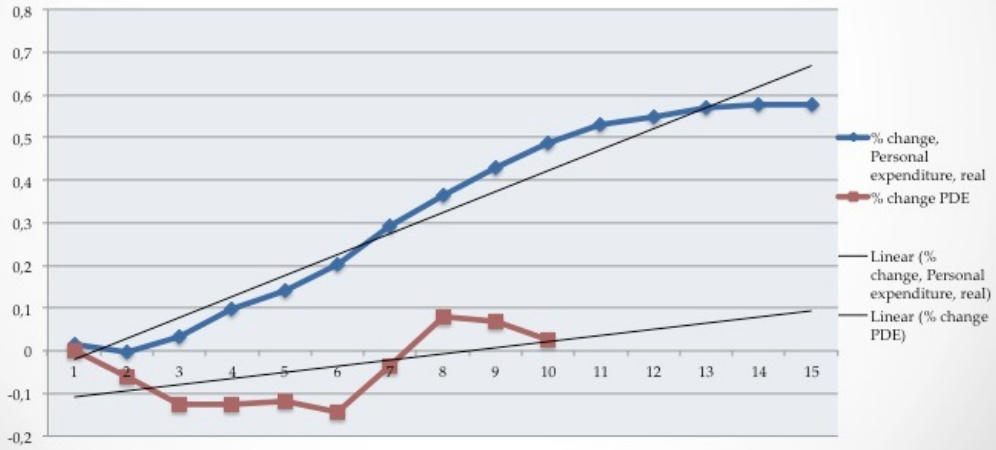


Comparison public health -Output and real expenditure

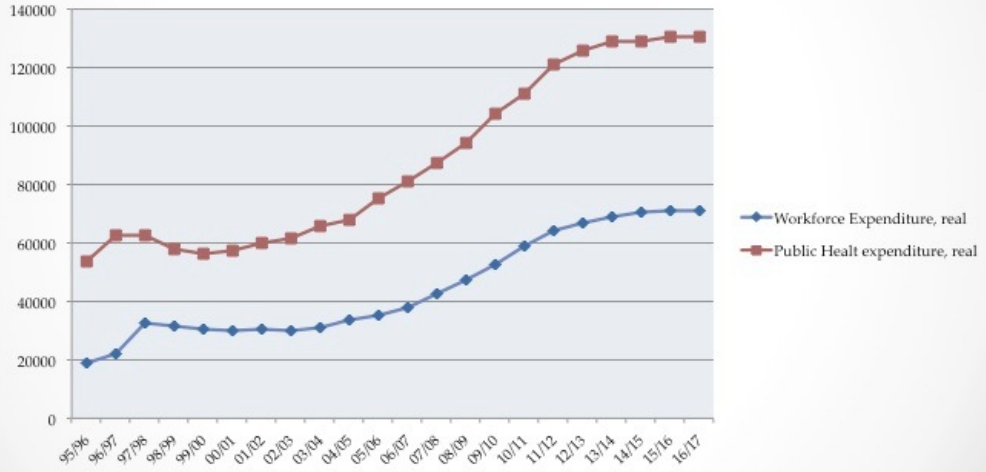


Trend

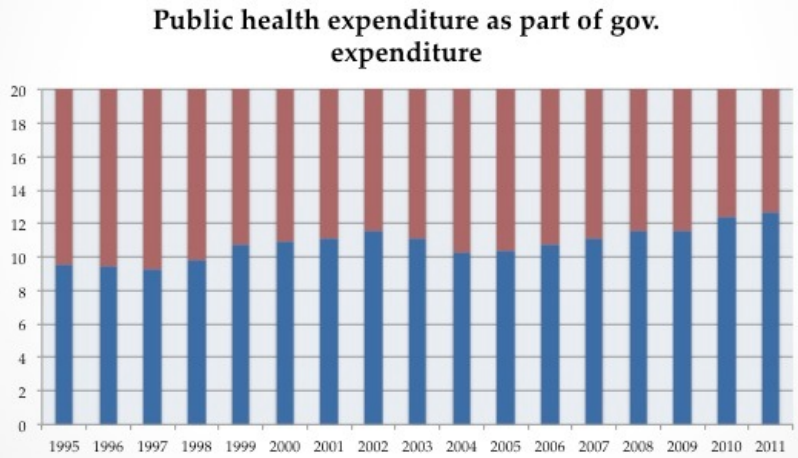
Percentage change and future trends



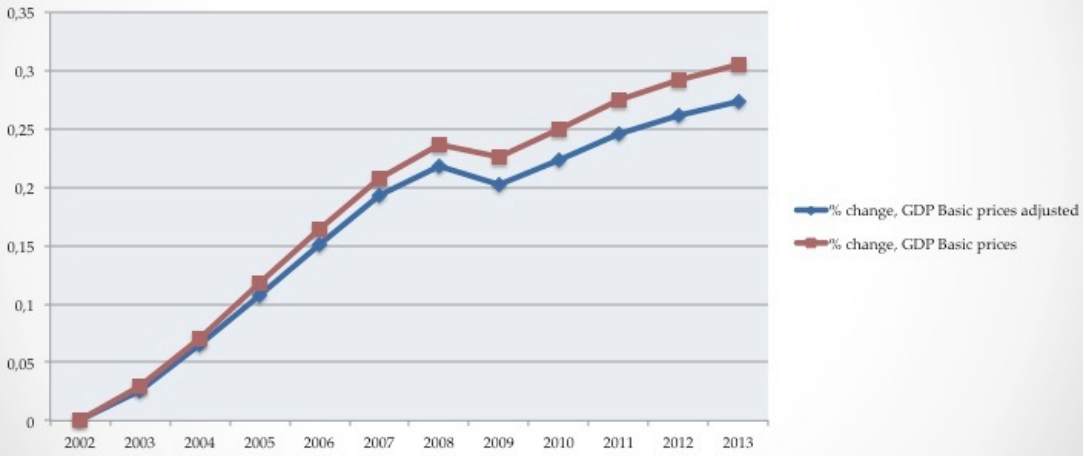
Comparison public health -Total health expenditure and workforce



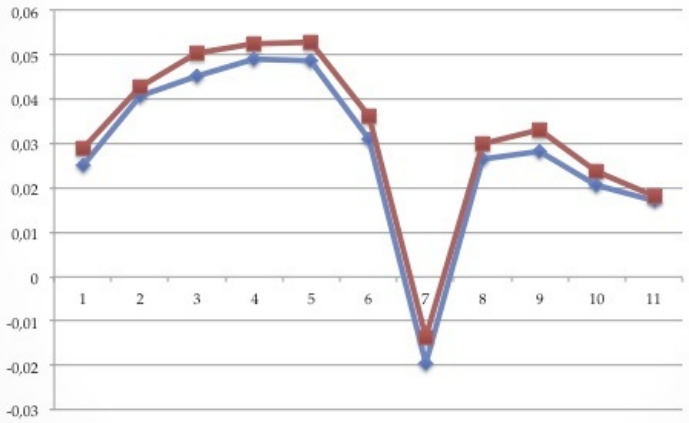
Public health as part of government expenditure



GDP growth comparison -Actual and adjusted



GDP growth comparison -Actual and adjusted



DRG

- DRG: Diagnose related groups

Sweden:

- 10 000 diagnoses ➡ 500 DRG
- Resources used per DRG Calculated through CPP
- Weight per DRG:
  - Sum of resources used per diagnose/ number of diagnoses in DRG
  - A. cost per DRG = Sum of average cost for all DRG's/ Sum of all DRG
  - Weight DRG = Cost DRG/average cost all DRG

Appendix 5: Interview guides

Statistics South Africa

- How is the value added for government services at constant prices calculated?
- What Ministry or institution is responsible for the calculations?
- What Ministry or institution is responsible for the publications?
- How does the data get aggregate to an national level?
- What data regarding case mix in the public health sector exist on an national level?
- How many employees are there in the government services?
- How many employees are there in the public health sector?

National Treasury

- What aggregated data on input into government services exist on an national level ?
- What aggregated data on input into the public health sector exist on an national level ?
- What aggregated data on output into government services exist on an national level ?
- What aggregated data on output into the public health sector exist on an national level ? (E.g., case-mix data, PDE data)
- What data regarding value added in constant prices for the government services exist?
- What data regarding value added in constant prices for the public health sector services exist?
- What data on outcome and quality in the public health sector exist on a national level?
- What would the consequences be if GDP at constants prices is overestimated?
- How value added calculated for the government services in South Africa?

Doktorn

- How has productivity changed since 2000/2001?
- Have you noticed changes in funding?
- Is the increases in wages reasonable compared to for other occupations?
- How would you say the quality of the public health sector have developing during the last 10-20 years?

Interview Weskoppies Hospital - 2014-XX-XX

The topics that will be discussed during the meeting will as previously mentioned be:

Employment data
-How has the number of employees at the hospital changed (by occupation; nurses, medical officers, administrative personal)?
-How have the wages for these categories changed?
-How has the PDE changed over the last 10-20 years?
-How has the cost per PDE changed over the last 10-20 years?
-How has the mix of PDE changed?
-What are the number of hospital beds and what is the bed utilization over the past 10-20 years?

Case mix data
-Does a data for the hospitals case-mix exist?
-Cost per activity divided accordingly to the case-mix?
-What are the major difficulties with measuring case-mix?

Productivity and funding data
-How has the overall productivity and efficiency of the hospital changed during the last 10-20 years?
-How has the funding to the Hospital changed during the last 10-20 years?
-How have the hospital management been working to increase productivity during the last 10-20 years?
-What are the problems of increasing productivity and efficiency?

Quality data
-How have the overall quality of the public health sector changed during the last 10-20 years, and what would be the cause of this?