Using DEA to Investigate Expenditure Factors Impacting Efficiency of Human Development in Sub-Saharan Africa

A Project Proposal

# Project Introduction

The Sub-Sahara African developing countries are considered extremely rural and impoverished, making health, education and basic wealth for quality of life as luxuries. Even though in the last decade, Sub-Saharan Africa has experienced widespread growth, many of these gains have not yet improved the region’s food security or access to water. Thus, to investigate factors impacting efficiency of Human Development in Sub-Saharan Africa, especially in the developing countries, is very meaningful.

In this project, I wish to demonstrate that inefficiency in the utilization of financial resources can have an incidence Human Development scores. Thus, owing to a certain “waste” in their use of resources, countries with similar levels of spending may end up with differing levels of human development. I measure this efficiency using the Data Envelopment Analysis (DEA) method.

# Project Approach

The UNDP Human Development reports introduced a way of measuring development by combining indicators of life expectancy, educational attainment and income into a composite human development index, the HDI. While considering the fact that Sub-Saharan [Africa](http://www.theguardian.com/world/africa) cannot sustain its much-heralded economic growth unless it eliminates the [hunger](http://www.theguardian.com/global-development/hunger) that afflicts nearly one in four of its people, provides basic life and health environment and improves its education, my project would also concentrate on basic human development issues like food, health, education and poverty, which means I will not only use the HDI indicators as my target variables. On the other hand, development of Sub-Sahara African human development appears to be an aid-dependent one, so their use of resources also covers the international aid part.

In order to assess countries’ efficiency in achieving a certain value of Human Development, I will perform inter-country comparisons and hold their results up to a target. The DEA method allows us to determine this target, which is defined by the best performers in the sample. In this project, I suppose countries use several inputs in order to maximize their development level. So I retain an output-oriented approach because it appeared plausible to me that Sub-Sahara African developing countries would prefer maximizing the Human Development for a given level of resource investment over minimizing the inputs, or resources, for a given level of HDI.

Consider *N* countries *n* (*n* = 1 ... *N*)*.* Each country uses *R* variable inputs *xr,n* (*r* = 1 ... *R*) to produce *M* outputs *ym,n* (*m* = 1 ... *M*)*.* National technologies are approximated by Farrell’s method (1957). The model is resolved *n* times (each country is designated unit 0, the reference unit, in turn) using the following linear program:



# Dataset

To conduct my research I will draw on World Bank data available in the World Development Indicators Online (WDI) database. This database provides access to many indicators of development.

Owing to loss of data, I will perform my model on most but not all of the Sub-Sahara African developing countries from year 2005 to 2011.

In order to explain the level of education (level of health, respectively) attained in the countries considered, my approach is to consider expenditures on education (or healthcare, respectively). However, these data are missing when long periods of time are considered. To mitigate this problem, I use a stock variable (stock in the year 2005 as an explanatory variable for the non-income HDI in the year 2011). This stock is assumed to represent all expenditures having been made prior to the date considered. Thus, for health and longevity, I use the number of nurses and midwives per 1000 people. In my opinion, the number of nurses and midwives present in the year 2005 should reflect healthcare related expenditures in preceding years. All the other variables I will use in the model are drawn from worldbank, and they’ll be divided by population if not per capita:

**Output variables:**

[Agricultural land (% of land area)](http://data.worldbank.org/indicator/AG.LND.AGRI.ZS)

[Food production index (2004-2006 = 100)](http://data.worldbank.org/indicator/AG.PRD.FOOD.XD)

100%- [Prevalence of HIV, total (% of population ages 15-49)](http://data.worldbank.org/indicator/SH.DYN.AIDS.ZS)

100%-Incidence of tuberculosis (per 100,000 people)

GDP per capita (current US$)

Revenue, excluding grants (% of GDP)

[Life expectancy at birth, total (years)](http://data.worldbank.org/indicator/SP.DYN.LE00.IN)

School enrollment, secondary (% gross)

Improved sanitation facilities (% of population with access)

**Input Variables:**

[Health expenditure per capita (current US$)](http://data.worldbank.org/indicator/SH.XPD.PCAP)

Net ODA received per capita (current US$)

Public spending on education, total (% of GDP)

External debt stocks, total (DOD, current US$)

## Conclusion

This project is to measure the efficiency of Human Development in Sub-Saharan African developing countries using the Data Envelopment Analysis (DEA) method, so that it could give a picture of expenditure factors impacting efficiency. By vertically compare the change of effectiveness’s of one country from 2005 to 2011 horizontally compare effectiveness of these countries in each year, differences and trends could be found to make meaningful implications.

# References

1. <http://hdr.undp.org/en/statistics/hdi/>
2. Africa Human Development Report 2012: Towards a Food Secure Future <http://www.undp.org/content/undp/en/home/librarypage/hdr/africa-human-development-report-2012/>
3. World Bank Indicators <http://data.worldbank.org/indicator>
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