MACROECONOMIC IMPLICATIONS OF HEALTH SECTOR REFORMS IN UGANDA: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

Judith Kabajulizi, Richard D. Smith and Marcus R. Keogh-Brown
Department of Global Health and Development
London School of Hygiene & Tropical Medicine

Abstract

Healthcare reforms in Uganda have been largely evaluated using partial equilibrium analysis which is ill-equipped to estimate the cascade effects resulting from certain public healthcare interventions. This paper sets out to determine the economy wide impacts of healthcare reform policies with simultaneous health effects; using a recursive dynamic computable general equilibrium (CGE) model for Uganda, based on a health-focused Social Accounting Matrix (SAM). An increase in the health sector budget share coupled with the envisaged improvements in the population health status leads to higher GDP growth rates; more employment and reduces the number of people living below the poverty line. The policy implication is that the government of Uganda should increase the health sector share in the national budget so that more funds are invested in health improvement activities for its population.

Key words: Healthcare, Computable general equilibrium, Poverty

1. INTRODUCTION

Uganda has been reforming the health sector since 1992 when a government White Paper on Health (1992) and a Three Year Plan Frame 1993-1995 for the health sector, outlined the agenda for health sector reform within a national health policy framework. Prior to 1992 Uganda's health sector underwent four distinct phases of change: expansion of the health

sector after independence in 1962; the political turmoil of 1970s coupled with global recession that ruined the whole economy; the implementation of primary healthcare (PHC) (Declaration of Alma-Ata 1978); and the 1986 to 1993 phase characterised by vertical and fragmented health programmes (Macrae, Zwi et al. 1996; Okuonzi and Birungi 2000). The healthcare reforms of 1992 were undertaken with an overall aim of improving the health of the population, with the intermediate objectives of improving sector efficiency, equity of access and utilization, and the quality of health services (World Bank 2006). The reforms included introduction of user fees, reforms in the pharmaceutical sector, sector wide approaches in health, decentralisation of health services delivery, reorganisation of the hospital sector, public-private partnerships in health, and restructuring of the ministry of health.

The effectiveness of healthcare reforms in Uganda has been evaluated in a number of studies that have identified the direct impacts linked to the performance of the health sector and the resultant health outcomes (Jeppsson and Okuonzi 2000; Kivumbi and Kintu 2002; Ssengooba, Atuyambe et al. 2002; Jeppsson, Ostergren et al. 2003; Kyaddondo and Whyte 2003; Kivumbi, Nangendo et al. 2004; Okuonzi 2004; Amone, Asio et al. 2005; Ssengooba, Yates et al. 2006; Örtendahl 2007; Ssengooba, Rahman et al. 2007; Okuonzi 2009; Pariyo, Ekirapa-Kiracho et al. 2009). Overall, the impact on quality of health services, both technical quality and quality assessed by consumers; the efficiency in resource mobilization, allocation and utilization in the health sector; and equity in access and utilization of health services is mixed. While there are improvements in some health system performance indicators attributable to reforms in the sector, there is also notable poor performance in some of the system indicators throughout the reform period. As the defining goal of any health system, population health is paramount in the design of any health sector reforms. While acknowledging the time lag for reforms to have an impact on health outcomes, there has been improvement in some health indicators and the Health Sector Strategic Plan (HSSP) performance indicators have been achieved in some areas such as immunization. The overall health indicators are still poor compared to countries with similar settings as Uganda implying that we are yet to see the full impact of health reforms on the population health status. There is evidence to suggest that similar healthcare reforms have been effective in some developing countries leading to improved health outcomes for sections of populations (Cross, Huff et al. 1986; Bossert and Beauvais 2002).

The healthcare sector evaluation studies have taken a narrow 'partial equilibrium' focus that has only identified the direct impacts of healthcare reform and ignored the economy-wide effects. It is argued that a typical partial equilibrium analysis is ill-equipped to estimate the cascade effects resulting from certain public healthcare interventions since the implicit assumption of partial equilibrium within the health sector or the economy are violated by such interventions (Beutels, Edmunds et al. 2008). The suggestion is to combine the information from estimated cost-effectiveness of healthcare interventions with macroeconomic data, such as social accounting matrices; in a computable general equilibrium (CGE) model, to estimate the shocks to the economy of various policy interventions.

There are not many CGE models that have addressed the interaction of healthcare service delivery with the rest of the economy. The macroeconomic impact of healthcare provision has been investigated using a static CGE model of an open UK economy (Rutten 2004; Rutten and Reed 2009). A recursive dynamic model of Botswana has modelled the economy wide impacts of healthcare interventions to combat HIV/AIDS (Dixon, McDonald et al. 2004). Other CGE models in health have assessed the macroeconomic impact of a disease in developed country settings (Smith, Yago et al. 2005; Keogh-Brown, Smith et al. 2009; Smith, Keogh-Brown et al. 2009; Keogh-Brown, Wren-Lewis et al. 2010); and developing country settings (Kambou, Devarajan et al. 1992; Arndt and Lewis 2000; Arndt and Lewis 2001; MacFarlan and Sgherri 2001). Whilst these studies have contributed to the CGE literature in health, most of them are static models unsuitable for capturing the long term effects of healthcare as health effects are lagged; and are in developed country setting. The dynamic models employ highly aggregated level of households, sectors and factors of production which limits the analysis in capturing the differential impacts on various categories of households, sectors, and labour skills. Moreover, the developing countries models investigate the impact of a particular disease and not healthcare policy. The impacts of healthcare provision policies on absorption, inflation, exports and imports, which are of interest to developing countries; are not explicitly reported in some of these studies.

This study is addressing the research gaps by developing a recursive dynamic CGE model to predict the impacts of healthcare reform policies with simultaneous health effects, based on a health-focused Social Accounting Matrix (SAM). The Uganda SAM 2007 is purposefully updated with the health sector expanded into private healthcare, public primary healthcare and public other healthcare, distinguishing the health intermediate input supply sectors; the

factor supply (capital, skilled and unskilled labour); and household categories (based on residence – rural and urban, and whether they are farming or non-farming households). A reallocation of the government budget to the health sector is modelled simultaneously with the envisaged consequential health status improvements. The health status improvement is captured by an increase in labour supply, and labour and total factor productivity. The increase in labour supply and factor productivity results from improved child and maternal health, improvements in the health status of the labour force, reduction in patient waiting times as the ratio of health workers to population improves with improved labour productivity in the health sector; and increased savings and investments as people expect to live longer. The rest of the paper is structured as follows. Section 2 presents the methods with the specification and description of the model in 2.1, the Uganda SAM describing the disaggregation of the health sector in 2.2; and the design of healthcare policy reform scenarios and the health impacts of health investments described in 2.3. Section three presents the results of the counterfactual simulations of reallocation of resources to the health sector while section 4 discusses the results. Section concludes with a brief.

2. METHODS

The suitability of CGE modelling lies in its ability to determine numerically the characteristics of an observable general equilibrium, and providing a logical and consistent way to analyse policy issues which involve several economic agents. CGE modelling is also able to analyse several policy shocks simultaneously to capture their combined impact, and to investigate effects of policy changes from internal or external shocks on macroeconomic variables. However, CGE modelling is criticised for an inability to statistically test model results, relying upon sensitivity analyses to solve the problem of potential errors from using parameters that are not obtained using econometric techniques. CGE modelling is also challenged on the choice of parameter values, choice of functional forms (McKitrick 1998); and quality of data sets (Iqbal and Siddiqui 2001), all of which are more general challenges encountered by any model, and addressed according to the economic problem being investigated. CGE modellers recognize the challenges and therefore tend to emphasize the broad themes of the results rather than the precise numbers they produce, thus validating CGE models as a form of approximate numerical investigation to explore the size of particular policy effects and signing the net outcome where different effects come into play (Whalley 1985).

2.1 DESCRIPTION OF THE UGANDA DYNAMIC CGE MODEL

The dynamic computable general equilibrium (DCGE) model for Uganda is an attempt to explicitly model the health sector disaggregated as non-government-healthcare, government-primary-healthcare, and government-other- healthcare; interlinked with the rest of the economy, to predict the effects of healthcare reforms. It draws from the standard static CGE model documented in (Lofgren, Harris et al. 2002) and extensions by (Thurlow 2005). The model incorporates dynamic factors to derive the impacts of healthcare policies on national income; production in various sectors; market shares; income of the various labour skills and different household types; and welfare. Specifically, issues pertaining to increasing resources available to the health sector are simulated in the model.

Model closure

For fiscal balance, the model assumes government savings are flexible while all tax rates and real government consumption are fixed. Healthcare spending is considered to follow the healthcare reform expenditure pattern. Under this closure real fiscal balance adjusts if government revenue receipts change. For the external balance (measured in foreign currency), foreign savings are fixed while the exchange rate is flexible to clear foreign exchange markets. The consumer price index (CPI) is the numeraire, and is fixed at its base. For savings-investment balance, the model assumes a savings-driven closure with flexible investment. Thus the marginal propensities to save for households and enterprises are fixed and real investment expenditure adjusts to equal the volume of savings available to finance it. Alternative closure rules are experimented in the model.

Recursive Dynamics

The model is recursive dynamic in order to appropriately capture the impacts of healthcare policy changes in the economy. Capital accumulation is modelled endogenously whereby investments in the current period build on the new capital stock for the next period. Allocation of new capital is influenced by each sector's initial share of aggregate capital, and the final sectoral capital allocation in the current period is dependent on the rate of depreciation and the sector profitability rates from the previous period. This feature enables the model to capture the impact of healthcare reform policies on capital accumulation. Population and labour supply growth rates are exogenously supplied from a demographic model. Factor productivity rates are updated according to observed trends from previous

studies. Government spending growth rates are updated according to the pattern of expenditure in the national accounts. The model is calibrated from the Uganda Social Accounting Matrix (SAM) of 2007, which is augmented with a disaggregated health sector.

2.2 UGANDA SOCIAL ACCOUNTING MATRIX (SAM)

The Uganda SAM 2007[1] is a 122 by 122 matrix representing 50 sectors, 6 factors, and 8 institutions; with a GDP of 21 billion shillings comprising of 21.4% agriculture, forestry and fishing; 25.8% industry; and 46.9% services. Table 4.1 presents the macro SAM aggregated into activities, commodities, factors, institutions and taxes. The economy largely produces for domestic consumption whereby 41% of locally produced goods and services are purchased by households for final consumption, 26% are used by enterprises as intermediate inputs, 11% for investment, 8% are exported while the government consumes about 6%. Households are categorised into five groups according to residence and whether they are involved in farming or non-farming activities i.e. household-rural- farming, household- rural-non-farming, household-Kampala- non-farming, household- urban-farming, and household-urban-non-farming. Almost all household income accrues from factor payments either directly or indirectly through enterprises. Government earns a considerably large share of its income (35%) from foreign transfers indicating the significance of foreign aid to the Ugandan economy. Similarly, it earns 27% from import tax compared to 17% from commodity tax and 18% from direct taxes (by households and enterprises). This further reveals the economy's vulnerability to external shocks and a narrow domestic tax base. Moreover, government domestic investment is only 24% compared to 42% from foreign sources and 34% from households.

[1] Original SAM was constructed under a project by IFPRI details of which can be found in Thurlow, J. (2008). "A 2007 Social Accounting Matrix for Uganda.", International Food Policy Research Institute, Washington, DC, USA. .

Table 1 MACRO SAM (Million Uganda Shillings)

	ACT	COM	FAC	HOU	GOV	ROW	S-I	INSTAX	IMPTAX	COMTAX	TOTAL
ACT		33,598									33,598
COM	12,316	4,197		18,732	2,689	3,631	5,191				46,756
FAC	21,283										21,283
HOU			21,283	12,385	- 125						33,543
GOV						1,386		693	1,045	659	3,783
ROW		7,256									7,256
S-I				1,733	1,219	2,239					5,191
INSTAX				693							693
IMPTAX		1,045									1,045
COMTAX		659									659
TOTAL	33,598	46,756	21,283	33,543	3,783	7,256	5,191	693	1,045	659	

Source: Uganda SAM 2007

Note: ACT=activities, COM= commodities, FAC=factors, HOU=households, GOV=government, ROW=rest of the world, S-I=savings-investment, INSTAX=institutional tax, IMPTAX=import tax, COMTAX=commodity tax

Classifications in the SAM

The sector/commodity mapping in the SAM comprises of 28 agricultural sub-sectors, 16 industry and 6 services while there are 6 factors and 5 households. Table 4.2 presents the grouping in each category.

Table 2: Classification and mapping in the Uganda SAM 2007

Sectors		
Agriculture	**Industry**	**Services**
Maize	Meat processing	Trade
Rice	Fish processing	Hotels & catering
Other creals	Grain processing	Transport
Cassava	Feed stock	Communications
Irish potatoes	Other food processing	Banking
Sweet potatoes	Beverages & tobacco	Real estate
Matooke	Textiles & clothing	Community services
Oil seeds	Wood & paper	Other private services
Beans	Petrol & diesel	Research & development
Vegetables	Fertilizer	Public administration
Fruits	Other chemicals	Education
Flowers	Machinery & equipment	Health
Cotton	Furniture	
Tobacco	Other manufacturing	
Coffee	Energy & water	
Tea, cocoa & vanilla	Construction	
Cattle		
Poultry		
Other livestock		
Forestry		
Fishing		
Mining		
Factors		
lab-self	labour self employed	
lab-unsk	labour unskilled	
lab-skll	labour skilled	
cap	capital	
cat	cattle stocks	
lnd	land	
Households		
hhd-r-f	rural farming households	
hhd-r-nf	rural nonfarming households	
hhd-k-nf	kampala nonfarming households	
hhd-u-f	urban farming households	
hhd-u-nf	urban nonfarming households	

Source: Uganda SAM 2007

Disaggregation of the health sector in the Uganda SAM 2007

The innovation in this analysis is the addition to the pre-existing SAM a disaggregated health sector with three new accounts namely non-government healthcare, government primary healthcare, and government other healthcare. While creating the new health sector accounts, aggregate totals from the original SAM are preserved (that is, shares are used from other sources rather than actual numbers). The following section describes the entries in the SAM

that pertain to the health sector and how they are treated to obtain the disaggregated SAM with three new accounts representing the health sector.

Health production activities

The aggregate value for intermediate inputs in the production of healthcare in the original SAM represents both government and non-government expenditure on health inputs, and is thus split into non-government, government- primary healthcare, and government –other healthcare, using the shares derived from data specified below. Intermediate input shares for the production of a government health good are derived from the government health expenditure data for 2007/08 collected by UBOS. The data set contains health expenditure information coded according to economic and function classification outlined in the Uganda Government Finance Statistics Classification (GFS) manual, 2011; and the Classification and Chart of Accounts, 2011. The economic classification shows the types of expenses incurred for the activities while the function classification gives information on the purpose for which an expense is incurred (Uganda Bureau of Statistics 2011a; Uganda Bureau of Statistics 2011b). In addition to the two guiding documents, the International Standard Industrial Classification of All Economic Activities (ISIC) revision 4 (United Nations 2008), is used for clarity of definition of various items/services.

The intermediate health inputs for the production of a government healthcare good are further split into inputs that go into production of "primary healthcare" services and those for "other healthcare" services. The input expenditure shares by level of healthcare are also obtained from UBOS health expenditure data for 2007/2008. This data set presents three health expenditure centres namely central government, district and urban authorities. The central government expenditure data is distinguished between recurrent and development expenditure. In addition donor expenditure is distinctly presented in the data set. For Urban Authorities and Districts, all inputs expenditure under primary healthcare heading were constituted into the share for primary healthcare input expenditure, and the rest of the expenditure functions were summed up with all Central government and Donor expenditure to get the share for other healthcare input expenditure.

Factors in healthcare production

There are six factors of production in the SAM: 3 labour -self-employed, unskilled, and skilled labour; capital; and land.

The factors for health activity are the value-added to the health sector generated by labour, land and capital - the value of health GDP at factor cost. In the Uganda SAM 2007, the value added to the health sector is generated by labour and capital only. Thus, it is these two factors that are further disaggregated to the desired level in the health sector.

Labour

Only two of the labour categories (un-skilled and skilled) in the SAM generate value added in the health sector. The labour survey module in the UNHS 2005/06 and the international standard classification of occupations (ISCO-08) are used to obtain shares of health sector labour by skill, and by employment status (private/non-government and public/government). To maintain consistency with the existing SAM, skilled labour comprises of managers, professionals, and technician and associate professionals; while unskilled labour comprises all the other classes specified in the ISCO-08, including clerical support workers and elementary occupations. The above categorisation is further adjusted for education level, to correct any misclassification of persons that might have been grouped as unskilled and yet they possess a vocational qualification or university degree and above. To put the labour classification into context, table 4.4 shows the mapping of ISCO occupations and skills to the ISEC-97 levels of education and the Ugandan education level as well as the grouping for skilled and unskilled labour employed in the health sector in the enhanced SAM.

Table 3 Mapping of ISCO occupations and ISCO skill levels to ISCED-97 levels of education and Ugandan levels of education, and labour classifications in the SAM

ISCO code	**Occupation/Classification**	**ISCO Skill level**	**ISCED-97 level of education**	**Ugandan level of education**
	Skilled labour			
1	Managers	3+4	6, 5a, 5b	University degree and above
2	Professionals	4	6, 5a	University degree and above
3	Technicians and associate professionals	3	5b	Vocational education
	Unskilled labour			
4	Clerical support workers	2	4, 3, 2	Secondary level education
5	Service and sales workers	2	4, 3, 2	Secondary level education
6	Agricultural, forestry and fishery workers	1+2	1, 2, 3,	Primary/Secondary education
7	Craft and related trades workers	1+2	1, 2, 3,	Primary/Secondary education
8	Plant and machine operators, and assemblers	1+2	1, 2, 3,	Primary/Secondary education
9	Elementary occupations	1	1	Primary level education
0	Armed forces occupations	1+2+4	1, 2, 3,4,	

Source: ISCO-08 and UNHS 2005 Labour survey module

The public/government health sector labour is further divided into those working in the primary healthcare and those employed in "other healthcare" sub-sectors using shares from the health expenditure on compensation of employees for 2007/08. The data clearly distinguishes wages and salaries expenditure for primary healthcare in the District and Urban Authority expenditure centres. Thus, this made up the share for primary healthcare while the rest, including wages and salaries from Central government; were classified to constitute the share for "other level of healthcare". However, it is important to note from this data, that the wages and Salaries accounts do not distinguish between skill levels. Hence, the same shares were applied to both skilled and unskilled categories.

Capital

Shares for private and public capital were obtained by taking the total government capital formation derived from the health expenditure data 2007/08 as a ratio of the existing SAM value. The shares obtained were comparable to the national accounts' private and public shares of capital formation for the same year(Uganda Bureau of Statistics 2010). Shares for government primary healthcare and government other healthcare, were derived from the detailed itemised government health expenditure data 2007/08.

Healthcare commodity output

This value represents gross output, which is derived as the sum of intermediate demand and GDP at factor cost. It is thus the value of total marketed health sector output. The SAM distinguishes between activities and commodities, thus facilitating interactions between single/multiple activities and single/multiple commodities. Hence splitting this cell into the desired health sector levels; results into single entries along the main diagonal of the activity-commodity sub-matrix (i.e. a one-to-one mapping between health activities and health commodities). The healthcare output is consumed by households and government. There are five households categorised according to residence and whether farming is their main economic activity.

Households' healthcare consumption

This is the payment from households for healthcare commodities and it is equal to the household consumption of marketed production of health services. The Uganda SAM 2007 does not distinguish between home consumption, which is activity based and household's marketed consumption, which is commodity based. Hence the value in this cell represents both. Household healthcare consumption shares are computed from the household survey (UNHS 2005/06). The household roster and section 9 of the survey questionnaire were used

to group households by residence –rural and urban, and to create farming and non-farming household categories. If a household member operated a non-agricultural enterprise or activities that produce goods or services, such a household was classified to be non-farming. Section 5 of the survey contains questions that sought answers about household members' healthcare seeking behaviour when they fell sick and the cost of consultation. Any response that did not indicate government hospital and/or government health unit was classified as expenditure at a private health unit. Similarly, to obtain household expenditure shares by levels of healthcare, any response that indicated hospital, whether government or NGO; was characterized as "other healthcare" while the rest were taken to be "primary healthcare".

Government healthcare consumption

This is the value of government consumption spending for the purchase of health services. In this regard, government is both a sector producing health services as well as a demander of these services. The shares for government spending in the primary healthcare and other healthcare are taken from the government medium term expenditure framework (MTEF). The MTEF data categorizes government expenditure by sector and votes within the functional classification, and includes donor project funds. Thus in the health sector the vote for district NGO hospital/primary healthcare and district primary healthcare were considered to constitute the government consumption spending for primary healthcare services while all the other expenditure votes were considered to constitute consumption spending for "other healthcare".

Balancing the SAM

The SAM is balanced by the cross-entropy method using a GAMS program for balancing a SAM (Fofana, Lemelin et al. 2005). It is necessary to balance the SAM because data sources are diverse and represent different time periods. While balancing the SAM, the cell values for government consumption were fixed so as to obtain as near as possible the original SAM coefficients for government allocation.

2.3 DESIGN OF HEALTH SECTOR REFORM POLICY SCENARIOS

In the process of reforming the health sector the Uganda government developed a series of national health policies (NHP) and health sector strategic plans (HSSP) in line with the National Development Plan (NDP), to guide investment in the sector. Given the limited resources available to the government the NHP recommends a national minimum healthcare package (NMHCP) to be delivered to the population. The HSSP provides an overall

framework for the health sector and prioritizes the components of the NMHCP clustered as: (i) health promotion, environmental health and community health; (ii) maternal and child health; (iii) communicable diseases control; (iv) prevention and control of non-communicable diseases (NCDs), disabilities and injuries and mental health problems. The composition of the NMHCP is guided by the country's disease burden and therefore aims to achieve allocative efficiency given the limited resources available. An allocation of health resources is said to be efficient if it maximises the sum of utility (health gain). Therefore by channelling resources to eliminate diseases that constitute the highest burden to the population, the sum of health gain is maximised and hence allocative efficiency achieved. The objective of the NMHP is…."to ensure universal access to quality minimum healthcare that consists of promotive, preventive, curative and rehabilitative services for all priority diseases and conditions, to all people in the country, with emphasis on vulnerable groups" (Uganda MoH 2010).

In order to achieve the planned objectives in the health sector it is necessary to expand and improve the health system such as rehabilitation of old and construction of new health centres as well as equipping them with medical care resources. The low level of productivity in public health units due to high rates of absenteeism and rampant employment dualism[2], which is estimated to cost the public health sector 26 billion Shillings (World Bank 2010c), needs to be addressed. In the following section, health sector reform policy scenarios are designed and potential future effects of the policies are modelled and reported in the results section.

2.3.1 The base case scenario

The base run simulation acts as a benchmark against which the impacts of health sector reform policies are measured. It serves to portray how the economy would have performed from 2008 to 2022 in the absence of effects accruing from healthcare reform policies. It assumes business continues as usual for internal and external factors, and policies that underpin the economy's rate of growth. The model is calibrated with a capital growth rate that emulates the historical growth path. The average GDP growth has been about 5.3% since the year 2000 and is predicted to continue growing at that average (Uganda Bureau of Statistics 2004; Uganda Bureau of Statistics 2012). Macroeconomic and sectoral policies

[2] Health workers hold more than one job, which can even be in a different sector; as a survival strategy

prevailing by the end of 2007 are assumed to remain throughout the model period. Hence government functional expenditure shares for the health sector and other sectors are constant for the base run. However, the aggregate government consumption expenditure is set to grow at an average of 3% in the base run, as observed from the national accounts (Uganda Bureau of Statistics 2004). Uganda is an open small economy, and thus its growth performance is affected by world market commodity prices and access to international capital markets. For the base run therefore, the world demand and world prices for Ugandan products' and net capital inflows are unchanged from their 2007 levels. However, foreign savings have been observed to grow at an average 3% since 2000/2001[3], and therefore this growth is reflected in the base run. For the internal flows, there is no real growth for investment and technical progress remains the same for all years. In Uganda the labour force comprises of persons aged 14-64 years. According to Uganda's demographic model this population category grows at rate of 4% (from the United Nations population statistics) while total population grows at 3%. Hence labour supply in the base run is set to grow at 4%, which is assumed to be the same for all the five labour categories; while household population growth rate is set at 3%.

2.3.2 Healthcare financing reform under a fixed government budget with health status effects on population and productivity in all sectors (HLTEXP1)

The experiment in the model is to increase government expenditure on health under fixed tax rates such that the immediate effect is to reduce government resources available to other government functions. Health expenditure as a share of GDP has been rising steadily since 2000/2001 owing to the country's economic growth- 7% (Uganda Bureau of Statistics 2012; Uganda MoH 2012). Despite the growth in health share in GDP, health share in total government budget still remains below the Abuja declaration target of 15% (African Union 2001).

Furthermore, the trend in health expenditure by levels of care depicts a disproportionate increase in spending for primary healthcare compared to other levels of care for the years 2001/2002 to 2010/2011. Out of the total health expenditure, primary healthcare grew at an average of 16.5% while other healthcare expenditure increased at an average of 11.8% for the same period (Uganda Bureau of Statistics 2012; Uganda MoH 2012). The skewed

[3] UBOS, Statistical Abstract 2012

expenditure towards primary healthcare is likely to continue with the NDP emphasis on preventive care and curative care. Moreover, the NDP 2010/11-2014/15 prioritizes investment in the health sector with emphasis on preventive and curative care (The Republic of Uganda 2010). This further suggests that government health expenditure will continue to grow.

Using the 2007/08 functional government expenditure data, shares for primary healthcare and other levels of care are derived and translated into the desired expenditure shares to meet the Abuja target of 15%. Thus, the share for government consumption of primary healthcare is raised to 8% and 7% for other healthcare. Since government functional spending is a proportion, total spending must add up to one. Therefore while increasing the proportion for healthcare expenditure; the additional expenditure to health is taken from the two biggest government expenditure shares proportionately (i.e. public administration and defence). All the other government function expenditure proportions remain as in the base case. In addition, given the observed trend in growth of government healthcare expenditure[4], I impose a minimum expenditure growth rate of 10% and 5% for primary care and other care respectively. The government closure rule adopted in this experiment assumes tax rates are fixed. This closure rule implies that the expansion in public healthcare provision serves to reduce government resources available to other sectors. This is because total government consumption is fixed in real terms. Furthermore, the specified factor market closure (factors are fully employed and mobile across sectors) implies the quantity of each factor supplied is fixed and the economy-wide wage rate varies to equate the supply to demand for factors.

Health effects in the model

In order to portray a complete picture of the impacts of healthcare reforms, the policy proposals described in the simulations are implemented simultaneously with the anticipated health impacts on the population via the effects on labour supply and factor productivity. The pathways of health investment and the values for the labour and factor productivity parameters used in the model are described below.

The healthcare reform policies modelled in this study are, so to speak; health improvement investments. Consequently implementing the policies has a direct and indirect health impact

[4] Annual Health Sector Report 2010/2012

on labour supply and factor productivity in the economy. Data on the impact of health improvement investments on labour supply and factor productivity in Uganda is not readily available. However, studies have shown that investing in health improvement has direct impacts on labour market participation rates, worker productivity, and indirect impacts on investment in physical capital, fertility and population age structure (Bloom and Canning 2000; Bloom, Canning et al. 2003; Bloom and Canning 2005; Dunkelberg and Spiess 2007; Frijters, Johnston et al. 2008).

Impact on labour supply

The impact of health investment on labour supply is introduced in the model as an exogenous shock with growth rates derived from a demographic model, based on assumptions and empirical data described here. Labour force supply has been associated with investing in child health through the increased proportion of the population that survives to working age (Bloom, Canning et al. 2003). There is evidence to suggest that rapid decline in child mortality (1950s and 1960s) in Asia spurred an increase in the economically active population that greatly contributed to the observed spectacular growth in GDP (Bloom and Williamson 1998). Moreover studies on the influence of maternal and child health on the maternal labour supply have shown that the better the mother's well-being the higher the probability of her working, and that mothers were less likely to work if their child had a severe health problem (Dunkelberg and Spiess 2007; Frijters, Johnston et al. 2008). Furthermore, family planning services save resources that would have been spent on complications of unplanned pregnancies and reduces fertility rate (Moreland and Talbird 2006). Declining fertility rates counteract the effects of a baby boom resulting from improved child health thus reducing the dependency ratio that would wipe away the benefits and increase per capita income.

In Uganda, between the two recent Uganda national household survey (UNHS) years, 2005/06 and 2009/10; the economically active population (15-64 years) increased at an average of 5% per year (Uganda Bureau of Statistics (UBOS) 2010). Given the population dynamics and the anticipated labour participation rates, I assume the economically active labour supply in the economy will increase by 5% annually. Therefore, for all the model experiments the base growth rate in labour supply is increased by 5%.

Impact on technological progress (factor productivity)

Total Factor Productivity: Skill-neutral technical change

Total factor productivity is an indicator of the long term performance of the sectors in the Ugandan economy as it relates the volume of sector outputs to the volume of inputs. In general terms TFP improvement occurs if sectoral outputs grow faster than inputs. Conversely, if a given volume of healthcare output is produced using less input, then technological progress has occurred in the healthcare sector. Investment in healthcare enhances human capital as it improves worker's productivity by enhancing their physical and mental wellbeing, and increases labour market participation rates as workers suffer fewer lost days due to illness or caring for the sick. Using adult survival rates as a proxy for population health for a constructed panel of countries dating from 1960 through 1995, Bloom and Canning estimated that a one percent point increase in adult survival rates increases labour productivity by about 2.8 percent (Bloom and Canning 2005). This finding, though higher; is consistent with *Weil*'s calibrated result of around 1.7 percent (Weil 2006). Additionally, physical capital improves as healthy people's perception that they will live much longer, leads to higher savings rate and increases investment as a proportion of GDP. Using life expectancy as a proxy for health, *Bloom, Canning et al (2002)* investigated the impact of longevity on aggregate savings for a number of countries including Uganda. They found that on the whole, health impacts the length of working life and that a ten year increase in longevity was associated with a 4.5% increase in savings rates, although Uganda's result was a contrast where a sharp decline in life expectancy from 1980 was associated with a sharp decline in savings rate after 1980 (Bloom, Canning et al. 2002). Moreover, people's survival rates increase and population, thereby expanding the pool of potentially productive ideas and raising the probability of inventions. Weil 2006 also postulates that a healthier workforce that supplies more efficient units also attracts more physical capital, a further evidence of the effect of health in raising physical capital per worker and consequently total factor productivity *(Weil 2006).*

Based on evidence from these studies, and cognizant of the fact that labour input also depends on the presence of other inputs, I assume the extent of improved health service delivery reforms on total factor productivity in all sectors to increase by 2.8%. This means less quantity of factors of production (labour, capital and land) are used for the same level of

output. Conversely, holding all factor inputs at the same quantity level, more output is generated.

2.3.3 Healthcare financing reform under a fixed government budget with health status effects, patient waiting time and productivity in health sector only (HLTEXP2)

In this simulation factor productivity resulting from increased efficiency in use of resources as a result of public spending in the health sector is modelled together with the impacts on health status, productivity in the health sector and reduction patient waiting time. Healthcare spending is assumed to enhance productivity of labour in the healthcare sector only, which reduces waiting time for patients seeking care. While, in general terms; productivity is an efficiency measure, measurement of public sector efficiency is a broad theme that I do not delve into here[5]. However, increased efficiency of public healthcare spending is used broadly to refer to aspects such as the volume and cost of healthcare services; the accessibility of health services; peoples' satisfaction with the healthcare services; and the use of resources according to objectives and priorities of the health sector. Specifically, the policy targets to eliminate employment dualism and absenteeism in the public health sector by increasing salaries for healthcare workers which in turn will increase worker motivation and retention, and ultimately their productivity. It is postulated that an increase in health worker time devoted to healthcare service delivery will reduce patient waiting time while seeking care and that the time saved is reallocated to productive activities. Consequently, labour participation rates and effective labour supplies will increase in all sectors of the economy. The NDP targets to reduce absenteeism by 28% while the Health Sector Strategic Investment Plan (HSSIP) targets 20% annualised reduction in absenteeism of health workers (MoH, Health Systems 20/20 et al. 2012). These two indicators translate into about 2% "present" and 1.5% growth in "present". For purposes of modelling the interaction between the public health sector efficiency and the rest of the economy, the "present" rate[6] is loosely translated to reflect an increase in labour supply and productivity in the health sector, while the 1.5% is used as a proxy for the annual growth rate. Similarly, for simplicity; the increase in the number and productivity of health workers is assumed to increase economy wide effective

[5] There are studies that have measured productivity in public sector: X. Li and D. Prescott (2009) for measurement of productivity in a service sector; K. Yu (2011) and A. Huttl et al (2011) on measurement of efficiency/productivity in a healthcare sector; Partnership Resource Centre (2006) for a review of productivity in the public sector. It has not been possible to combine this study with another study to measure the efficiency of the health sector in Uganda. This is a task for another study to follow.

[6] "Present" can be taken to mean man-hours actually spent engaged in healthcare service delivery activities.

labour supplies by 4%[7], deduced from the expected increase in the ratio of health worker to the population from the current 1.8 per 1000 population to 1.9 per 1000 population. The economy wide effective labour supply is assumed to grow annually at a rate of 5% (the annual average growth in labour force aged 14-64 between the two household surveys UNHS 2005/06 and UNHS 2009/2010); while a 2.8% growth rate is assumed for total factor productivity in the public health sector.

Table 5.1 Summary of the DCGE model scenarios and assumptions

Scenario	**Assumptions imposed**	**Targeted direct impact**
Base-run	Exogenous growth in population/labour, government expenditure allocations remain at same levels as in FY2007/2008	GPD growth rates follow historical path, average growth of 5.3%
Simulation HLTEXP1	Reallocation of government budget to health sector, health share in government spending increases Health effect: larger number of children survives to working age, improved health status of labour force, increased longevity in life expectancy	Government primary healthcare and other healthcare rises to 8% and 7% respectively; labour supply annual growth rate is 5%; total factor productivity increases by 2.8% in all sectors
Simulation HLTEXP2	Reallocation of government budget to health sector, health share in government spending rises Health effect: reduction in patient waiting time while seeking care, saved time is reallocated to productive activities; health status of labour force improves	Government primary healthcare and other healthcare rises to 8% and 7% respectively; base labour supply in economy increases by 4% and grows annually at 5%; base public health sector labour supply increases by 2% and grows annually at 1.5%; and public health sector labour productivity and TFP grow at 2% and 2.8% respectively.

3. RESULTS FROM THE UGANDA DCGE MODEL WITH HEALTHCARE REFORM EFFECTS

The model is set to capture the impacts of resource reallocation to the health sector and the resulting health effects envisioned as increase in labour force to the economy and increased factor productivity. The results presented show the impacts of a government budget re-

[7] This rate is close to the 5% annual average growth in labour force aged 14-64 between the two household surveys UNHS 2005/06 and UNHS 2009/2010.

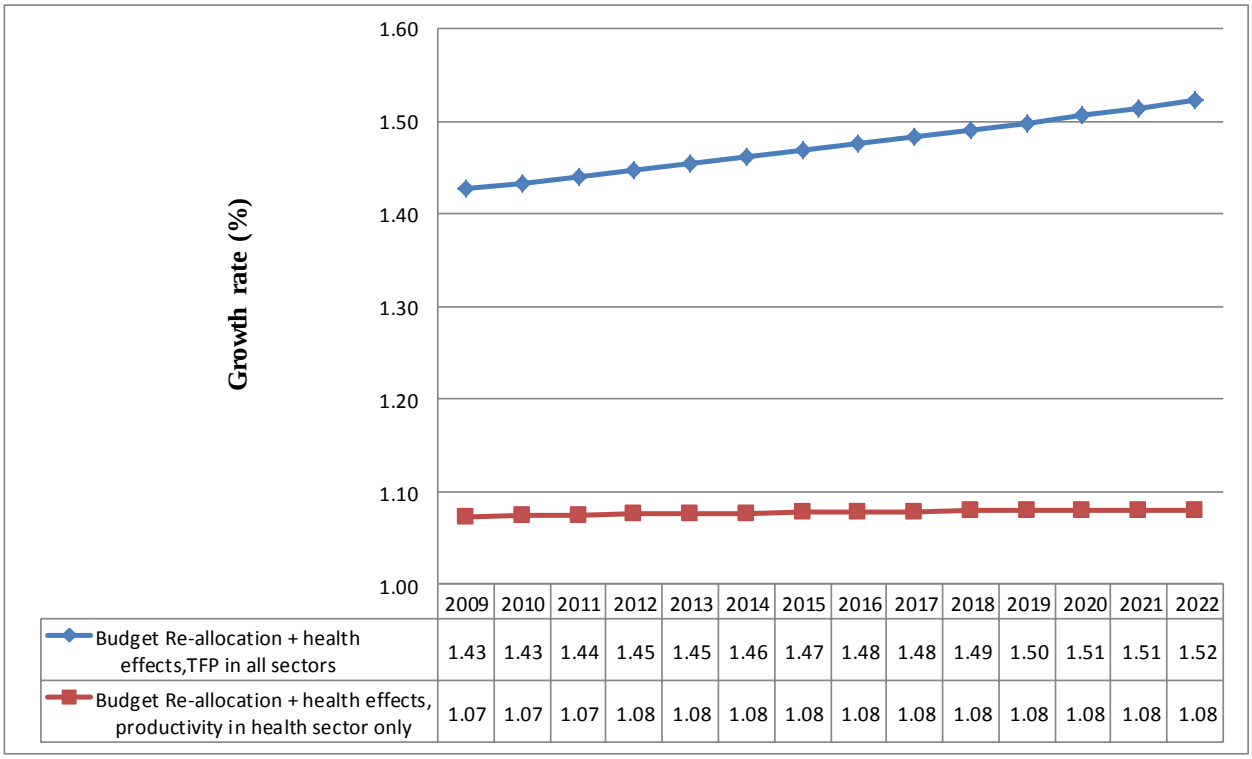
allocation to health sector coupled with increase in labour supply and total factor productivity (HLTEXP1 scenario); and reallocation to health sector with increase in labour supply and factor productivity in the health sector only (HLTEXP2 scenario), relative to the counterfactual. The results focus primarily on changes in macroeconomic variables and welfare, relatives to the base case.

It is observed that budget reallocation to the health sector coupled with the anticipated health effects leads to higher growth rates in all macro variables relative to the base budget allocation.

GDP effects

Figure 1 illustrates the GDP growth path over the years for the reallocation to the health sector coupled with the increase in labour force supply and total factor productivity in all sectors on one hand, and labour productivity in health sector only, on other hand. The figure indicates a cumulative difference in GDP growth between the base scenario and the reallocation with TFP in all sectors. This suggests that gains from increased labour force supply and total factor productivity reinforce the initial increase and fuel further growth.

Figure 1 Growth in GDP under the proposed Budget Re-allocation with health effects, relative to the base



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Budget Re-allocation + health effects,TFP in all sectors	1.43	1.43	1.44	1.45	1.45	1.46	1.47	1.48	1.48	1.49	1.50	1.51	1.51	1.52
Budget Re-allocation + health effects, productivity in health sector only	1.07	1.07	1.07	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08

It is instructive to consider the underlying sectoral growth rates under the different scenarios in order to understand the basis for the GDP growth. Table 7.2 presents the average GDP growth rates for the various sectors which underlie the GDP growth paths depicted in figure 1. When government increases the health budget coupled with the subsequent health improvements and higher productivity in all sectors (HLTEXP1 scenario), the productive sectors (agriculture and industry) grow by 1.5% faster - relative to the base. This result is follows from the fact that 67% of total labour force in Uganda is employed in the primary sectors[8]. The services sector also expands faster by an average of 1.4% relative to the base. To note is the growth in private healthcare which expands by 1.5% faster, relative to the base compared to 1% for primary healthcare and 1.2% for government other healthcare.

Table 4 Average GDP growth rates by sector under the different scenarios relative to the base

	Budget Re-allocation + health effects,TFP in all sectors	Budget Re-allocation + health effects, productivity in health sector only
	"HLTEXP1"	**"HLTEXP2"**
Overall GDP	1.5	1.1
AGRICULTURE	1.5	1.2
Of which		
Cereals	1.6	1.2
Root crops	1.5	1.1
Matooke	1.5	1.1
Pulses	1.6	1.3
Horticulture	1.5	1.1
Export crops	1.6	1.2
Livestock	1.5	1.2
Forestry	1.5	1.1
Fishing	1.5	1.2
INDUSTRY	1.5	1.1
Of which		
Mining	1.5	1.0
Manufacturing	1.5	1.1
Food processing	1.5	1.1
Non Food processing	1.5	1.1
Utilities	1.5	1.1
Construction	1.5	1.1
Services	1.4	1.0
Private	1.5	1.0
Health non-government	1.5	1.1
Public	1.4	1.1
Administration	1.0	1.0
Education	1.4	1.1
Health-Primary care	1.0	1.0
Health-Other care	1.2	1.0

Source: Author's computations from simulation results

When factor productivity is restricted to the health sector only(scenario HLTEXP2); the results in GDP and underlying sectoral growth from a reallocation of the budget to healthcare

[8] UBOS, Statistical Abstract 2012

still predict that sectors expand faster by an average of 1.1% relative to the base. Both private and public healthcare services expand at about the same rate relative to the base.

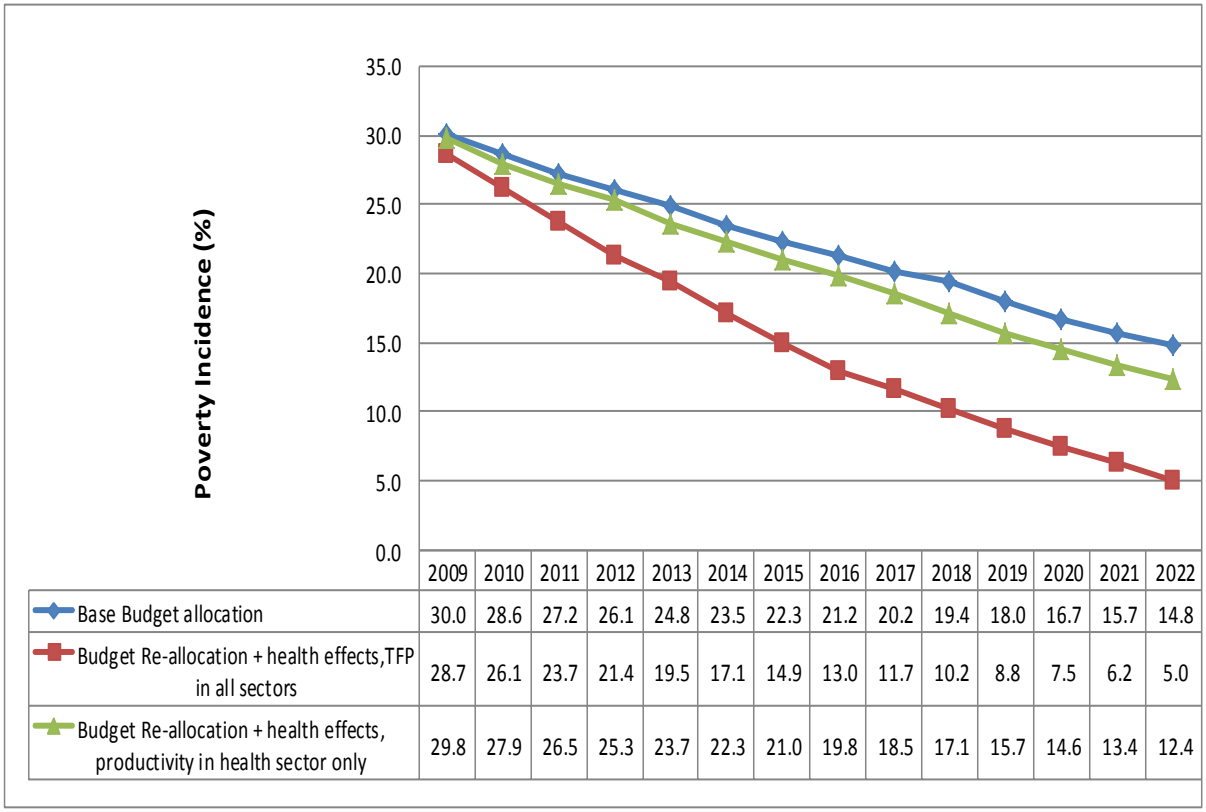
Employment and factor returns

When government increases expenditure to health sector with health effects and total productivity in all sectors (HLTEXP1 scenario), growth in demand for all factors of production is higher relative to the base budget allocation. Demand for self-employed labour which is solely employed in the agricultural sector, is 1.3% higher while total demand for unskilled labour is 1.2% higher. However, demand for unskilled labour in the public primary healthcare sector declines by 4.8%. Skilled labour employment goes up by 1.3% more while demand for capital increases more by 1.1%. However, there is an overall decline in demand for capital in the public services sector. Demand in the primary healthcare sector declines by 4.7% while there is a modest increase in demand for capital in the "Other healthcare" sector of 0.1%. On the other hand, when government increases the health budget with health effects and labour productivity confined to the health sector only (HLTEXP2 scenario), the results for factor demands are similar to HLTEXP1 and only differ in magnitudes, which are smaller. However, under this scenario the public primary healthcare demand for unskilled labour increases more by 0.9% while the demand for capital in the "Other healthcare" sector declines by 1.7%.

Welfare effects

A reallocation of resources to the health sector and the ensuing sectoral growth translates into large increases in household incomes that lead to welfare improvements. Welfare change is measured by the poverty head count indicator which gives the percentage of the total population estimated to be living in households with per capita real consumption (per adult equivalent) below the established official poverty line for Uganda. Figure 7.2 compares the welfare improvements from the different scenarios in the model.

Figure 2 Percentage of population below the poverty line under the different scenarios 2008-2022



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Base Budget allocation	30.0	28.6	27.2	26.1	24.8	23.5	22.3	21.2	20.2	19.4	18.0	16.7	15.7	14.8
Budget Re-allocation + health effects,TFP in all sectors	28.7	26.1	23.7	21.4	19.5	17.1	14.9	13.0	11.7	10.2	8.8	7.5	6.2	5.0
Budget Re-allocation + health effects, productivity in health sector only	29.8	27.9	26.5	25.3	23.7	22.3	21.0	19.8	18.5	17.1	15.7	14.6	13.4	12.4

Figure 2 shows the poverty incidence declining rapidly under the budget reallocation to the health sector with TFP in all sectors scenario (HLTEXP1). The percentage of people living below the poverty line is more than halved by the fifth year (2012) in the model experiment HLTEXP1. The observed trend suggests poverty will be dissipated by the year 2022 if government increases the health budget which translates into improved population health, higher labour supply in the economy and technological progress in all production sectors.

Since in Uganda majority of the poor are located in rural areas it is imperative to report the impacts on poverty dynamics by population residence. Figure 7.3 illustrates the effects of increased government healthcare expenditure and the resulting health effects on the reduction of poverty in rural and urban populations.

Figure 3 Percentage of Rural Vs Urban population below the poverty line under different scenarios: 2008 – 2022

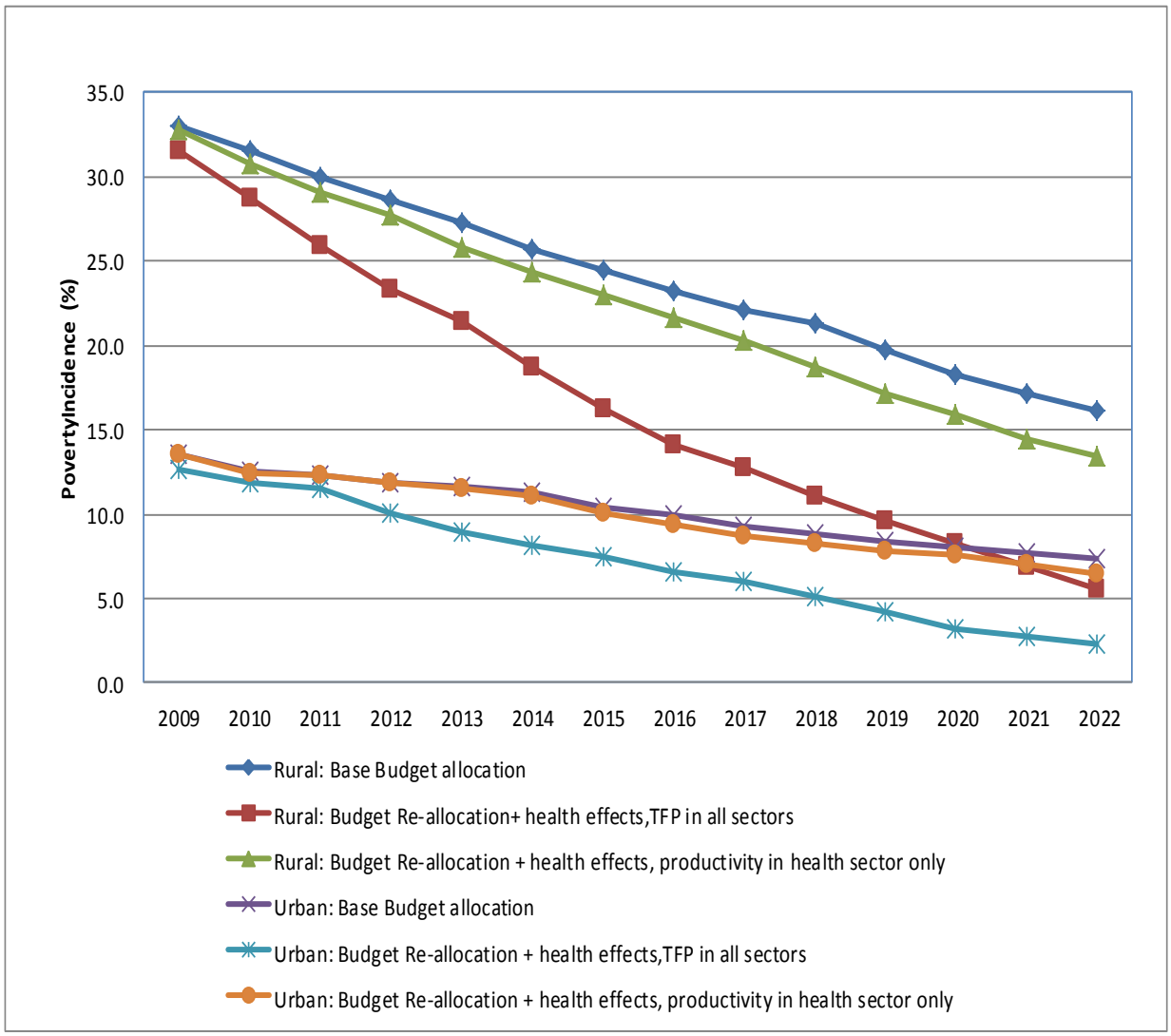
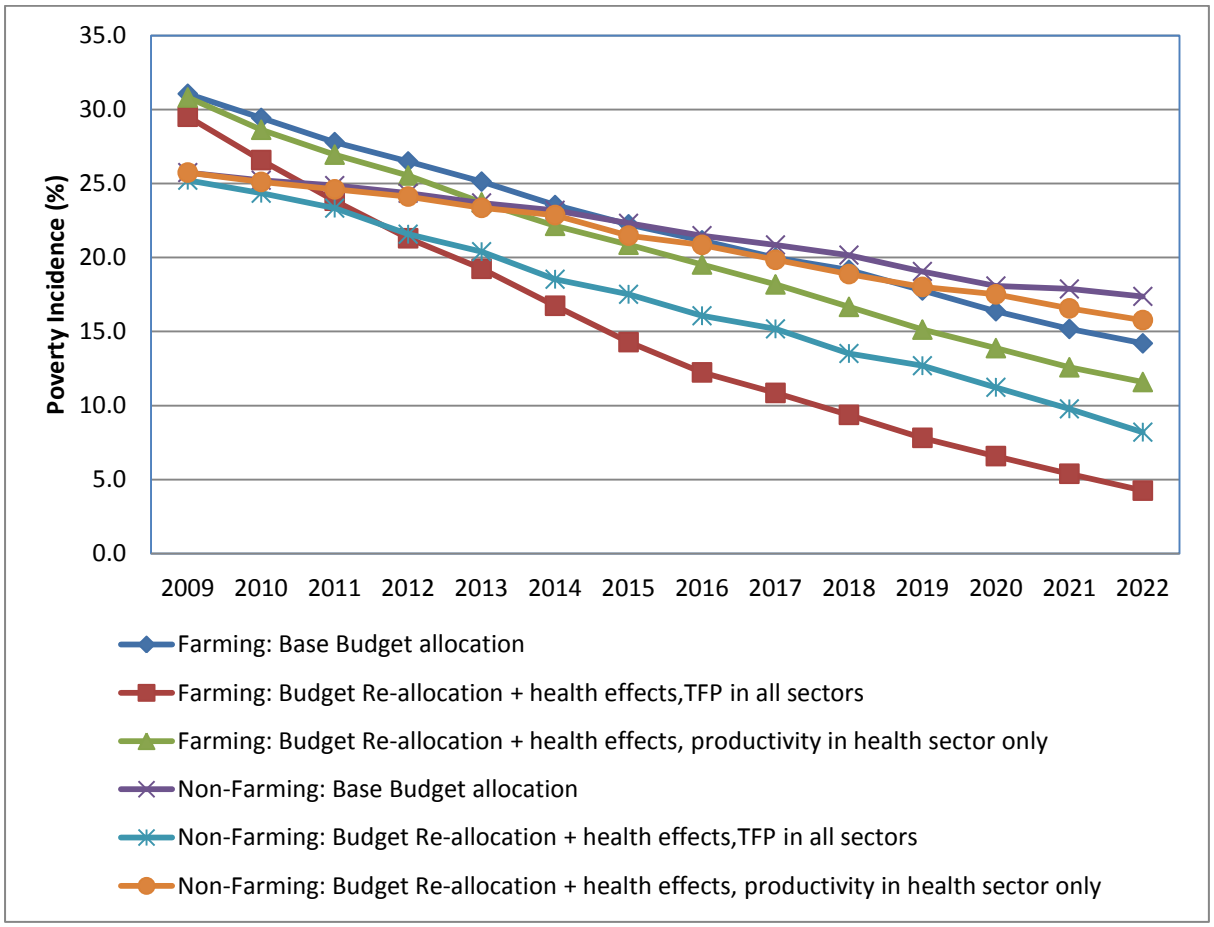


Figure 3 shows that when government increasing health expenditure budget that in turn improves population health and total factor productivity is particularly beneficial to reducing poverty. In both rural and urban areas poverty declines more rapidly as indicated by the steepness of the poverty curves compared to the base budget allocation. On the other hand, when the budget reallocation to the health sector improves labour productivity in the health sector only (HLTEXP2); both rural and urban poverty decline but at a gradual pace relative to the base scenario. In this case only up to about half of the poor population are rescued from below the poverty line by the end of the model period (see poverty tables in appendix).

Furthermore, given that agriculture is the backbone of Uganda's economy it is plausible to tease out the effects of increased government healthcare expenditure to farming and non-

farming households. Figure 4 illustrates the poverty trend for farming and non-farming households under different scenarios. It is observed that poverty declines at a faster rate among farming households both in the rural and urban areas compared to the rate of decline among non-farming households under the budget reallocation to health and productivity in all sectors.

Figure 4 Percentage of Farming Vs Non-farming populations below the poverty line under different scenarios



Source: Simulation results

4. DISCUSSION

The GDP impact results have shown the primary sector growing faster relative to the base when there are health improvements. This is because the health interventions that lead to higher child survival rates expand the labour force which directly benefits the primary sectors. Given the country's primary sector employment rate of 67%, an expansion in labour force implies that for every 100 new workers 67 of them will get to work in agriculture,

forestry, fishing, quarrying and mining thus increasing output from the sectors. Moreover, the primary sectors do not require highly skilled labour and absorb most of the unskilled labour in the economy implying that at the onset (as people become of working age) the additional labour force will start to produce.

Furthermore, expansion of the healthcare budget increases healthcare service provision, providing opportunity for increased access and utilization of healthcare. This results in improved health status of the population and the labour force thereby reducing the number of sick days off work, both for the labourers themselves and as carers for the sick. The improved productivity per worker from improved health is further reinforced by the art of learning by doing making further increases in total factor productivity and the resulting higher sector outputs. The observed expansion in all the sectors can also be explained by the inter-linkages between sectors. For example, the observed expansion in the agricultural sector spurs growth in the food-processing segment which in turn posits higher growth rates in the manufacturing sector. Additionally, the expanding labour force increases effective demand and market for manufactured goods which results in further growth for the manufacturing sector.

The sectoral GDP growth results have also shown that when the government expenditure in the healthcare sector increases coupled with health effects and productivity in all sectors, private healthcare service provision grows much faster compared to public healthcare provision. One of the possible explanations for the shift in production to private healthcare is that as the productivity of labour in the public sector rises, the cost per unit of output in public healthcare declines. Consequently fewer units of labour are hired because the same level of healthcare service delivery in the public healthcare sector can be achieved using fewer units of labour. This is particularly observed in the public primary healthcare sector where demand for unskilled labour declines by 4.8% whereas in the private healthcare sector demand for both skilled and unskilled labour is increasing relative to the base (see appendix table A1). This suggests that the health workers that are not hired by the public health sector are absorbed by the private healthcare sector which in turn boosts production in that sector.

Moreover, the literature suggests that people, particularly rural folks; were more likely seek healthcare from private providers relative to public healthcare providers even if there is a monetary cost attached to private healthcare while public healthcare services are provided

free of charge [9]. The opportunity cost of seeking public healthcare has been found to be higher relative to private healthcare. In terms of the model results, this suggests a growing demand for private healthcare delivery that leads to further growth in provision of private healthcare services. Whether this has implications for welfare in terms of increased out-of-pocket payments for private healthcare is reflected in the poverty analysis for this same scenario (see figure 3). It is observed that the percentage of poor people is more than halved in both rural and urban areas when government increases the health budget coupled with health effects and productivity in health sector only. This implies that although the policy leads to a shift in production of healthcare from public to private, the overall welfare impacts are positive.

The results for welfare impacts show that government increasing health expenditure budget that in turn improves population health and total factor productivity is particularly beneficial to reducing rural poverty. Both urban and rural poverty are seen to decline rapidly relative to the base. This result is not surprising given that majority of rural folks are self-employed in the agricultural sector so that any improvement in factor productivity and higher returns to factors, directly improves the incomes received by the rural households because they own the factors of production (self-employed labour, unskilled labour, and land). Similarly urban poverty is reduced substantially because the urban poor mainly engage in the informal (unregulated) sector, largely preoccupied with casual labour activities. Therefore any measure that improves the health and productivity of this category of population directly impacts on their ability to increase their earnings particularly selling their labour.

On the other hand when a budget reallocation to the health sector is coupled with increased labour productivity in the health sector only, there is gradual decline in poverty both in rural and urban areas. Again this result is not surprising because the health sector is skill intensive and skilled labour is largely owned by the non-poor. Therefore improvement in labour productivity, for example by government increasing salaries of workers in the health sector; directly benefits the skilled health workers and to a smaller extent the unskilled support workers in the sector. Nevertheless, we see a decline in poverty that is brought about by knock-on effects of increased healthcare expenditure combined with increased sector labour productivity which results in reduction in patient waiting time and improves labour

[9] See paper by Pariyo, Ekirapa-Kiracho, et al. (2009)

productivity economy wide. You will recall that the model assumed a modest improvement in health –worker to patient ratio from 1.8 per 1000 population to 1.9 per 1000 population. This is still far below the WHO recommended ratio of 2.3 per 1000 population. These results suggest that increasing the healthcare budget coupled with the ensuing health benefits has the potential to reduce poverty both in rural and urban areas. When the analysis is further decomposed to farming and non-farming households, results indicate that poverty among farming households declines faster when government reallocates resources to the health sector coupled with health effects and productivity in all sectors. This demonstrates that investing in health improvement activities has the potential to boost productivity and output in the agricultural sector which in turn spurs economic growth and accelerates poverty reduction.

5. CONCLUSION

The study sets out to investigate the macroeconomic impact of healthcare reforms in Uganda. Specifically the impact of a reallocation of government resources to the health sector and the simultaneous improvements in population health are investigated. Using a recursive dynamic CGE model for Uganda calibrated from the Uganda SAM that is augmented with a disaggregated health sector, the reallocation of resources to the health sector is modelled simultaneously with health effects. The health effect are modelled via an increase in labour supply resulting from improved child and maternal health, and reduction in patient waiting times as the ratio of health workers to population improves; and increased labour and total factor productivity from improvements in the health status of the labour force, and increased savings and investments as people expect to live longer.

The main findings indicate that a reallocation of the budget to the health sector coupled with health effects leads to higher growth rates in GDP relative to the base budget allocation. The sectoral GDP growth rates are more pronounced for productive sectors compared to the service sectors. However, in the service sector, the private healthcare provision expands faster than the public healthcare provision. The results are more pronounced when improvements in productivity are assumed to take place in all the sectors of the economy. The welfare impacts results also indicate rapid decline in poverty headcount relative to the base when there are health effects and total factor productivity improvements are assumed to take place in all sectors. Under the same scenario, rural poverty declines faster as well as

poverty among farming households. Even when productivity is assumed to take place in the health sector only, we still see a gradual decline in poverty that is faster than the base case scenario. It is therefore recommended that in order to achieve rapid economic growth and reduce poverty government should allocate more resources to the health sector. The policy implication is that the government of Uganda should increase the health sector share in the national budget so that more funds are invested in health improvement activities for its population.

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APPENDIX

Table A1 Factor demands by sectors: average annual growth rates (%) relative to the base

	Budget Re-allocation + health effects, TFP in all sectors	Budget Re-allocation + health effects, productivity in health sector only
	"HLTEXP1"	**"HLTEXP2"**
Self employed labour: Agriculture	1.3	1.0
Unskilled labour	1.2	1.0
Of which , Agriculture	1.3	1.0
Industry	1.3	1.0
Utilities	1.2	1.0
Construction	1.2	1.1
Services	1.0	1.1
Private services	1.2	1.0
Non-gov healthcare	1.2	1.0
Public services	0.8	1.2
Public Primary healthcare	-4.8	0.9
Public Other healthcare	0.3	0.8
Skilled labour	1.3	0.9
Of which, Industry	1.4	0.9
Utilities	1.4	0.9
Construction	1.3	0.9
Services	1.2	0.9
Private services	1.3	0.9
Non-gov healthcare	1.4	0.9
Public services	0.8	1.2
Public Primary healthcare	0.5	0.6
Public Other healthcare	1.0	0.7
Capital	1.1	0.9
Of which, Agriculture	1.2	1.0
Industry	1.2	0.9
Utilities	1.1	0.9
Construction	1.1	1.0
Services	0.8	1.0
Private services	1.1	0.9
Non-gov healthcare	1.1	0.9
Public services	-1.5	0.3
Primary healthcare	-4.7	1.0
Other healthcare	0.1	-1.7

Source: Author's computations from simulation results

Table A2 Rural vs. Urban poverty: Percentage of people below poverty line under the different scenario

	Rural: Base Budget allocation	Rural: Budget Re-allocation+ health effects,TFP in all sectors	Rural: Budget Re-allocation + health effects, productivity in health sector only	Urban: Base Budget allocation	Urban: Budget Re-allocation + health effects,TFP in all sectors	Urban: Budget Re-allocation + health effects, productivity in health sector only
2009	33.0	31.6	32.8	13.5	12.6	13.5
2010	31.5	28.7	30.8	12.6	11.9	12.4
2011	29.9	26.0	29.1	12.4	11.5	12.3
2012	28.6	23.4	27.7	11.9	10.1	11.8
2013	27.2	21.4	25.9	11.7	8.9	11.5
2014	25.7	18.7	24.3	11.2	8.1	11.0
2015	24.4	16.3	23.0	10.4	7.5	10.1
2016	23.3	14.1	21.7	9.9	6.5	9.4
2017	22.1	12.7	20.3	9.3	6.0	8.7
2018	21.3	11.1	18.7	8.8	5.1	8.3
2019	19.8	9.6	17.1	8.4	4.2	7.8
2020	18.3	8.3	15.9	8.0	3.2	7.5
2021	17.1	6.9	14.5	7.7	2.8	7.0
2022	16.2	5.5	13.5	7.4	2.3	6.5

Source: Author's computations from simulation results

Table A3 Farming vs. Non-farming households: Percentage of people below poverty line under the different scenario

	Farming: Base Budget allocation	Farming: Budget Re-allocation + health effects,TFP in all sectors	Farming: Budget Re-allocation + health effects, productivity in health sector only	Non-Farming: Base Budget allocation	Non-Farming: Budget Re-allocation + health effects,TFP in all sectors	Non-Farming: Budget Re-allocation + health effects, productivity in health sector only
2009	31.1	29.5	30.8	25.7	25.2	25.7
2010	29.4	26.6	28.6	25.2	24.3	25.1
2011	27.8	23.8	27.0	24.9	23.3	24.6
2012	26.5	21.3	25.5	24.3	21.6	24.1
2013	25.1	19.2	23.7	23.7	20.4	23.4
2014	23.5	16.7	22.1	23.2	18.5	22.9
2015	22.2	14.3	20.9	22.3	17.5	21.5
2016	21.2	12.2	19.5	21.5	16.1	20.9
2017	20.0	10.9	18.2	20.9	15.2	19.8
2018	19.2	9.4	16.7	20.2	13.5	18.9
2019	17.8	7.8	15.1	19.1	12.7	18.0
2020	16.4	6.6	13.9	18.1	11.2	17.5
2021	15.2	5.4	12.6	17.9	9.8	16.6
2022	14.2	4.3	11.6	17.4	8.2	15.8

Source: Author's computations from simulation results