Macroeconomic implications of healthcare financing reforms: A computable general equilibrium analysis of earmarked taxes for health in Uganda

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Abstract
Healthcare financing reform is common place across the spectrum of high to low income countries. The underlying pressures for reform are not the same but may be common to certain groups of countries in so far as questions regarding the role and responsibility of different actors with regard to healthcare financing, production, consumption and regulation are concerned. The global trend in healthcare financing reform is critical for not just health but also for wealth of populations – health is a core driver of economic growth. Moreover, the health sector itself is usually a very significant economic sector in its own right, and thus changes to it have direct impacts on the economy (as well as indirectly through health), yet there is little consideration of these wider macro effects. Healthcare financing 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 financing reforms in Uganda using a recursive dynamic computable general equilibrium (CGE) model calibrated from an updated health-focused Social Accounting Matrix (SAM). An increase in the health sector budget share and a health tax on households are modelled simultaneously with the envisaged improvements in the population health status which increases labour supply, labour productivity and total factor productivity in the economy. Results indicate that the proposed health budget share with the envisaged health effects leads to higher growth rates in GDP, private consumption, and reduced adverse impact on the decline in investment. Welfare improvement is observed in the poverty reduction rates. The policy implication is that earmarked taxes for healthcare are a sufficient and sustainable source of fiscal space for health in Uganda.

JEL classification: C68, H51, I15,

Key words: Healthcare, Computable general equilibrium, Taxes-for-health, Poverty, Uganda
1. Introduction
Healthcare financing reform is commonplace across the spectrum of high to low income countries. The underlying pressures for reform are not the same but may be common to certain groups of countries in so far as questions regarding the role and responsibility of different actors with regard to healthcare financing, production, consumption and regulation are concerned (Creese, 1994). The global trend in healthcare financing is critical for not just health but also wealth of populations – health is a core driver of economic growth (Bloom & Canning, 2000; Bloom & Canning, 2005; Bloom, Canning, & Sevilla, 2004; Fogel, 2004; World Bank, 2004). And also the health sector itself is usually a very significant economic sector in its own right, and thus changes to it have direct impacts on the economy (as well as indirectly through health), yet there is little consideration of these wider macro effects.

1.1 Uganda’s health sector reforms
Uganda has been reforming its health sector since 1992. The reform agenda has included: healthcare financing reforms - introduction of user fees in public health units (which were eventually abolished in 2001 due to poor performance), the compulsory social health insurance (SHIS) (recommended but not yet implemented), the pharmaceutical sector reforms which, among others, streamlined the financing, procurement and distribution of drugs, and sector wide approaches in health (SWAps) where all development partners are encouraged and tasked to channel healthcare funding through the central government budget; and organisational and policy reforms - decentralisation of health services delivery to districts and local governments, reorganisation of the hospital sector into a referral system, public-private partnerships in health such as the private-not-for-profit (PNFP) health units, and restructuring of the ministry of health; as well as the overall commitment by government to consistently increase the health sector budget share.

1.2 Healthcare financing in Uganda
Uganda’s total expenditure on health as a percentage of GDP has been on the increase since the 1990s rising from 5% in 1995 to 9.5% in 2011 (Uganda MoH, 2013; World Bank, 2010b; World Health Organisation, 2012). Funding for healthcare in Uganda comes from both private and public sources. Private healthcare funding sources include household out-of-pocket payments (as user fees in private for profit and private-not-for-profit healthcare centres) and to a lesser extent healthcare insurance schemes. The government budget allocation from general taxation and donor funds (both on-budget and off-budget) constitute the public healthcare expenditure which, combined together contribute more than two thirds of total healthcare funding. The Uganda national health accounts (NHA) study for 2009/10 healthcare expenditures estimated the total healthcare expenditure per capita at USD 51, reflecting a below standard healthcare per capita expenditure when compared to the WHO
recommended estimate of USD 60 that is required to provide the minimum healthcare package (Uganda MoH, 2013; World Health Organisation, 2012).

It is a universal challenge for countries to find adequate resources to finance their health systems such that there is an ever increasing attention to the question of how to increase financial resources for health - particularly by governments (Powell-Jackson, Hanson, & McIntyre, 2012). The challenge is even bigger for low income countries where the burden of disease is greatest and resources most scarce. Endeavours by governments to mobilise additional resources for a specific spending cause has come to be known as the creation of “fiscal space” - broadly defined as the capacity of government to provide resources for a desired purpose without any prejudice to the sustainability of its financial position or allocations to other sectors (Heller, 2005, 2006). In creating fiscal space (for health) the aim is for government to have budgetary room to increase resources available to spend on the desired healthcare activities without prejudice to others. (Heller, 2005, 2006) propose ways by which a government can create fiscal space for health which include: earmarked taxes for health, reallocation of resources to the health sector (prioritization in the budget), increasing external resources, and efficiency improvements in service delivery. Whereas each of the proposed sources of fiscal space can be pursued independently there is scope for interactions between them. For example prioritization of health sector spending in the budget can be jointly pursued with efficiency improvements in the sector.

For a government to adopt any one or a combination of the proposed measures to raise fiscal space for health depends on several factors that may include both political and socio-economic circumstances. It is argued that for governments with high expenditure shares of GDP, a consideration for prioritization of expenditures anchored towards merit goods such as healthcare should be the primary option. External resources in form of grants, though an attractive source of fiscal space, are an unreliable source in terms of sustainability since many donors are increasingly unable to commit to funding beyond the short term (1 to 2 years). Savings in form of efficiency improvements in healthcare service delivery are undoubtedly a good source of fiscal space for health in Uganda1.

Raising taxes to create fiscal space (which is the main focus in this paper) is recommended for settings where the tax share in GDP is low and may be less feasible if the tax burden is already high. The Uganda government total tax revenue has averaged 12.8% of total GDP since 2005/06, of which direct taxes are 3.8% of GDP (The Republic of Uganda, 2008, 2011; Uganda Bureau of Statistics, 2012). The share of direct taxes in GDP is an indication that the domestic tax base is narrow. Hence

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1 The economy-wide impact of efficiency improvements as a source of fiscal space for health is modelled in a separate research paper which is still a work in progress.
the proposed earmarked tax for health studied in this paper is levied as a direct tax on households, with an additional aim of broadening the tax base.

Earmarked taxes for health are advantageous in several ways:

2: the taxpayer is provided with an intrinsic accountability for government spending; they encourage transparency as people become aware of the cost of healthcare services and thus make informed decisions on the balance between tax burden and level of services; they are seen as a way to protect resources for healthcare from competing sectoral investments instigated by political interests. In principle the proposed earmarked tax revenue studied in this paper would be used to supplement healthcare expenditure (in addition to general taxation) and if at all there is a bounty during expansionary periods, it could be encroached on for spending elsewhere. There is no readily available data on earmarking taxes in Uganda. However, lessons can be drawn from experiences of similar schemes in countries such as South Africa, Ghana and Tanzania (Ataguba & Akazili, 2010; Carling, 2007; Diane McIntyre et al., 2008), and Australia’s experience where a 1.5% levy raises about 25% of public healthcare resources (Carling, 2007).

The effectiveness of the broad 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 (Amone et al., 2005; Jeppsson & Okuongi, 2000; Jeppsson, Ostergren, & Hagstrom, 2003; Kivumbi & Kintu, 2002; Kivumbi, Nangendo, & Ndyabahika, 2004; Kyaddondo & Whyte, 2003; S. A. Okuongi, 2004; S Agatre Okuongi, 2009; Ortendahl, 2007; Pariyo et al., 2009; Sengooba, Atuyambe, McPake, Hanson, & Okuongi, 2002; Sengooba et al., 2007; Sengooba, Yates, Cruz, & Tashobya, 2006). These studies have taken a narrow ‘partial equilibrium’ focus that has only identified the direct impacts of the healthcare reforms 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, & Smith, 2008; Rutten, 2004). 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. This conclusion has been alluded to by a number of other studies that have investigated the economy-wide impacts of health and healthcare policy such as the infectious disease impact studies (Chou, Kuo, & Peng, 2004; Keogh-Brown, Smith, Edmunds, & Beutels, 2009; Smith & Keogh-Brown, 2013; Smith, Keogh-Brown, & Barnett, 2011; Smith, Keogh-

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2 Common earmarked taxes for healthcare include levies on tobacco and alcohol. However, they are criticised for limiting the scope of government to allocate budgets as they see appropriate; and are usually linked to macroeconomic circumstances (how much revenue a tax can raise) rather than the population’s health needs. For a deeper discussion on tax earmarking, see Carling (2007).
Brown, Barnett, & Tait, 2009; Verikios, McCAW, McVernon, & Harris, 2010), HIV/AIDS impact in Africa (Arndt & Lewis, 2000, 2001; Dixon, McDonald, & Roberts, 2004; Kambou, Devarajan, & Over, 1992; Thurlow, 2007), non-communicable disease impact (Verikios, Dixon, Rimmer, & Harris, 2013) and others evaluating health related issues (Jensen et al., 2013; Smith, Yago, Millar, & Coast, 2005; Smith, Yago, Millar, & Coast, 2006).

This paper assesses prospectively the macroeconomic impact of healthcare financing reform policies in Uganda. Specifically the impacts of increasing the health sector share in the budget combined with a health tax modelled simultaneously with the envisaged health effects are investigated. The Uganda SAM is updated and the health account disaggregated into three accounts: non-government healthcare, government primary healthcare, and government other healthcare. The remainder of this paper is structured as follows. Section 2 presents a description of the model for Uganda and the SAM update procedure indicating the sources of data for the disaggregation of the health sector. The design of healthcare financing policy scenarios and the health effects of healthcare investments are outlined in section 3. Results of changes in the factor returns, impacts on macroeconomic variables and welfare are presented in section 4 and the discussion and conclusion in section 5.

2. Methods
A whole economy dynamic CGE model is applied to estimate and predict the impacts of government healthcare financing policies. 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. Several policy shocks can be analysed simultaneously in a CGE model to capture their combined impact, and to investigate effects of policy changes from internal or external shocks on macroeconomic variables. Although the CGE modelling technique is criticised for its inability to statistically test model results, it should be noted that in CGE modelling the emphasis is on the broad themes of the results rather than the precise numbers they produce. CGE models are thus a form of approximate numerical investigation to explore the size of particular policy effects and the course of the net outcome of the different policy effects.

2.1 Description of the Uganda dynamic CGE model
The dynamic CGE model for Uganda draws from the standard CGE model documented in (Lofgren, Harris, & Robinson, 2002). Specifically, we use the extended version by the International Food and Policy Research Institute (IFPRI) and linked to a micro simulation poverty module previously applied to South Africa and Botswana (Thurlow, 2005, 2007, 2008b). The model incorporates dynamic factors to derive the impacts of healthcare financing policies on factor prices, GDP, investment, and welfare changes measured by poverty reduction.
2.1.1 Production and commodities

The model assumes producers maximise profit by choosing quantities of inputs and output given the input and product prices, and subject to technological feasibility. Producers are assumed to earn zero profit and the technology used exhibits constant returns to scale. Each economic activity such as healthcare delivery production is defined by a specific production function in a two-step nested production technology where the bottom nest specifies the combination of primary factor inputs in a constant elasticity of substitution (CES) formulation to form the value added bundle (e.g. combining nursing labour with hospital inpatient ward). At the top nest the value added is combined with intermediate inputs such as medicines in healthcare production, in fixed proportions (Leontief technology) to produce the healthcare output such as the treatment given to hospital inpatients. The detailed disaggregation of production activities captures the changing structure of growth due to changes in healthcare financing and the envisaged health effects. Labour is assumed to be fully employed and mobile across sectors so that the economy-wide wage adjusts to equate supply to demand.

In the commodity markets, domestic output is allocated between domestic sales and export sales using the assumption that domestic producers maximise profit subject to imperfect substitutability between the two alternatives. The production possibility frontier of the economy is defined by a constant elasticity of substitution (CET) formulation between domestic supply and export. On the demand side, a composite commodity is made up of domestic demand and final imports and it is consumed by households, enterprises, and government. The Armington assumption is used to distinguish between domestically produced goods and imports. For each good, the model assumes imperfect substitutability (CES function) between imports and the corresponding composite domestic goods.

For the institutions, households receive income from factors and transfers, and spend their income on consumption, maximising utility subject to a budget constraint in a linear expenditure system formulation, pay taxes, and save according to their marginal propensities to save. The government collects tax to fund its expenditure and redistribute income. The equations for the government account are elaborated here to highlight the parameters affected by the policy simulations in section 3.

The government receives revenue from direct taxation of factors of production such as wage income tax, indirect taxation from domestic production and commodity outputs and import tariffs, and transfers from the rest of the world. Thus,

\[ Y_G = \sum_i TI_i + \sum_i TE_i + \sum_i TM_i + \sum_i TH_i + \sum_i TRG_{ROW} \]  

where \( Y_G \) is government income, \( TI_i, TM_i, TE_i \) are indirect taxes, import tariffs and export taxes on good \( i \), and \( TRG_{ROW} \) is transfer to government from the rest of the world (e.g. donor aid inflows).
Income taxes (on household and firms), export and import taxes are modelled as a fixed proportion of the value of income, exports and imports respectively, equations (3) to (5); and indirect taxes on sales on local production are evaluated at producer prices just as imports are evaluated at domestic prices, which include tariffs, equation (2). Thus,

\[TL_i = tx_i[P_iQ_i^e - Pe_iEX_i + (1 + tm_i)\bar{e}\bar{P}wm_iM_i]\]  
\[TM_i = tm_i\bar{e}\bar{P}wm_iM_i\]  
\[TE_i = te_iPe_iEX_i\]  
\[TH_h = tyh_hYH_h\]

where \(tx_i, tm_i, te_i\) are tax rate, tariff rate and export tax rate on good \(i\) respectively, \(tyh_h\) is the direct tax rate on income of household \(h\); \(\bar{e}\) is the exchange rate; \(P_i, Pe_i, \bar{P}wm_i\) are producer price, domestic export price, international import price in foreign currency, of good \(i\); and \(EX_i, M_i\) are the volume of exports and imports of good \(i\).

Government revenue is used for commodity consumption expenditure such as healthcare and transfers; and the remainder is saved. Thus,

\[Y_G = E_G + S_G\]  
\[E_G = C_G + TR_G\]

where \(E_G, C_G, TR_G\) represent government expenditure, commodity consumption, and transfers respectively.

\[C_Gi = \partial_Gi\bar{C}_G\]

where \(\bar{C}_G\) is total government consumption, and \(\partial_Gi\) is the share parameter for government consumption of commodity \(i\) in total government consumption. Government consumption expenditures on good \(i\), \(C_Gi\) are fixed in real terms (relative to the numeraire) at benchmark levels.

The fiscal balance is a flexible residual denoted as:

\[S_G = Y_G - \bar{C}_G\]

Total savings in the economy are a sum of domestic savings and foreign savings. Thus;

\[S = \sum S_h + S_G + eF\]

where \(eF\) is foreign capital flow converted to local currency by the exchange rate.

### 2.1.2 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 in the following formulation.

\[K_{i,t+1} = K_{i,t}(1 - \delta) + k_iINVTOT_t\]

where \(\delta\) is the depreciation rate of capital, \(INVTOT_t\) is the total investment in the current period \((t)\), and \(k_i\) is the share of each sector in total capital in the initial year. 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 financing reform
policies on capital accumulation. Population and labour supply growth rates are exogenously
supplied from a demographic model. Factor productivity and total productivity rates are updated
according to trends from empirical studies. The model is calibrated from the updated Uganda SAM
2007 which is augmented with a disaggregated health sector.

2.2 Updating and disaggregating the health sector in the Uganda SAM 2007

The Uganda micro SAM 2007 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. The primary innovation in the SAM analysis is the addition to
the pre-existing 2007 SAM of a disaggregated health sector with three new accounts: non-government
healthcare, government primary healthcare, and government other-healthcare. The health sector SAM
2007 value represents total healthcare expenditure which is the sum of government (public) healthcare
and non-government (private) healthcare expenditures. Government healthcare expenditure consists
of recurrent and capital spending from general taxation as well as external borrowings and grants from
international organisations. Non-government healthcare expenditure consists of direct household (out-
of-pocket) spending as well as private insurance and direct service payments by private corporations.

The rationale for disaggregating the health sector is to isolate the impact of a healthcare financing
policy shock transmitted through the different types and levels of care because the resource claims by
each type and level of healthcare differ. Non-government healthcare is paid for by the consumer at the
point of use while government healthcare is (mostly) free of charge to the consumer. Additionally
inputs and costs are different for the production of government healthcare by levels of care. For
instance, government primary healthcare comprises of preventive and curative services at lower level
health centres and sometimes at district general hospitals while government other-healthcare mainly
comprises of specialist services at regional referral hospitals and advanced tertiary care at national
referral hospitals, as well as general hospital services. Furthermore, the different socio-economic
conditions between rural and urban households may imply different patterns of consumption of
healthcare by levels of care. Consequently the impacts of a healthcare financing policy shock are
likely to differ for different types and levels of care.

Original SAM was constructed under a project by the International Food Policy and Research Institute
(IFPRI) details of which can be found in (Thurlow, 2008a; Thurlow, Diao, & Zhu, 2007).
Data for updating and disaggregating the health sector was obtained from the health expenditure data collected by the Uganda Bureau of Statistics (UBOS), the Uganda national household survey (UNHS) 2005/06, and the Uganda supply-use-tables (Uganda Bureau of Statistics, 2007). 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). It is necessary to balance the SAM because data sources are diverse and represent different time periods. The SAM is balanced using the cross-entropy (CE) method (Robinson, Cattaneo, & El-Said, 2000) in a GAMS program for balancing a SAM (Fofana, Lemelin, & Cockburn, 2005). 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.

3. Scenarios for government healthcare financing reforms and health effects

3.1 The counterfactual scenario

The counterfactual simulation acts as a benchmark against which the impacts of healthcare financing reform policies are measured. It serves to portray how the Ugandan economy would have performed from 2008 to 2020 in the absence of effects accruing from healthcare financing reform policies. The model horizon is selected to begin in 2008 in order to relate to the most recently available benchmark data set (Uganda SAM 2007) constructed in 2007. The existing SAM 2007 coefficients are not overtaken by time and therefore reflect the true picture of the functioning of the economy at the start of 2008. The model end period of 2020 is purposely selected to align with the five year health sector strategic and investment plans and the national development plans for the period 2010/11-2014/15 and 2015/16-2019/2020, all of which are embedded within the aspirations of Uganda vision 2040 (The Republic of Uganda, 2012), which directs that all national planning documents should prioritise the health sector.

The model is calibrated with a capital growth rate that emulates the historical growth path averaging 7% per annum (Uganda Bureau of Statistics, 2004, 2012). Macroeconomic and sectoral policies 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 assumed to follow the 2008 levels. The aggregate government consumption expenditure, is set to grow at an average of 3% per annum in the counterfactual simulation, as observed from the national accounts (Uganda Bureau of Statistics, 2004). In Uganda the labour force comprises of persons aged 14-64 years and according to the demographic model this population category has grown at a rate of 4% per annum over the last decade while total population has grown at 3% per year. Hence labour supply in the counterfactual

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4 The Uganda Bureau of Statistics is a government agency established by an act of parliament, responsible for coordinating, monitoring and supervising the National Statistics System.
scenario is set to grow at 4% per annum, which is assumed to be the same for all the five labour categories; while the household population growth rate is at 3% per annum.

3.2 Increasing the health sector share in the budget

The policy intervention is to increase the health sector share in government budget to achieve a 15% health share target by 2020. The 15% share target is selected to reflect the African Union recommendation in the Abuja Declaration which calls for all African governments to commit 15% of their budgets to health. The policy intervention is implemented in the model by increasing the government demand scaling factor for healthcare so that the government share parameter for healthcare consumption is raised to the desired level. From equation (8), government consumption of primary healthcare - \( C_{G(PC)} \) and other healthcare - \( C_{G(OC)} \) is given as:

\[
C_{G(PC)} = \partial_{G(PC)} \tilde{C}_G
\]

and

\[
C_{G(OC)} = \partial_{G(OC)} \tilde{C}_G
\]

where \( \tilde{C}_G \) is total government consumption, \( \partial_{G(PC)} \) and \( \partial_{G(OC)} \) are the share parameters for government consumption of primary healthcare and other healthcare respectively, in total government consumption. The desired healthcare financing policy requires that \( \partial_{G(PC)} \) and \( \partial_{G(OC)} \) constitutes 15% of total government consumption expenditure. Thus, in order to achieve the desired 15% healthcare share in the budget by 2020, the base value for government-primary-healthcare is set to increase by 35% per annum and government-other-healthcare by 27% per annum. Note that this is a recursive dynamic model so that the end period for each year forms the base for the next period.

3.3 The earmarked health tax

A direct tax on households is levied to raise additional revenue for healthcare financing. In order for government to raise the additional revenue so that it can spend 15% of the budget on healthcare without compromising expenditure allocations to other sectors, the direct tax adjustment factor is fixed at 11% per annum for households. That is, from equation (5), the parameter \( tyh_h \) increases by 11% for each household category so that each household contributes progressively to the tax revenue required to raise the health expenditure share in the budget.

3.4 Health effects in the model

In order to portray a complete picture of the impacts of the healthcare financing reforms, the proposed health budget share and the proposed health-tax on households are implemented simultaneously with the anticipated health effects on the population via the effects on labour supply, labour productivity and total factor productivity. The proposed healthcare financing reforms modelled in this study are intended to facilitate health investment improvements. Consequently implementing the policies has a
direct and indirect health impacts on the economy. Data on the impact of health improvement investments on labour supply, labour productivity and total factor productivity in Uganda is not readily available. The pathways of health investment and the values for the health effect parameters used in the model are obtained from literature. 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 & Canning, 2000; Bloom & Canning, 2005; Bloom, Canning, & Sevilla, 2003; Dunkelberg & Spiess, 2007; Frijters, Johnston, Shah, & Shields, 2008).

3.4.1 Healthcare effect on labour supply
The impact of health investment on labour supply is introduced in the model as an exogenous shock with growth rates obtained from empirical studies. Labour force supply has been associated with investing in child health through the increased proportion of the population that survives to working age (Bloom et al., 2003). There is evidence to suggest a positive association between decline in child mortality growth in GDP (Bloom & Williamson, 1998). Other studies have shown that child health is positively correlated with mother’s labour participation rate (Baird, Hicks, Kremer, & Miguel, 2012; Dunkelberg & Spiess, 2007; Frijters et al., 2008). Furthermore, family planning services save resources that would have been spent on complications of unplanned pregnancies and also reduces the fertility rate (Moreland & 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. Evidence from Uganda shows that 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). This growth in labour force is attributed in part, to the health sector reforms initiated since 1992. Therefore given the population dynamics and the anticipated labour participation rates, the economically active labour supply is assumed to increase recursively at a rate of 5% per annum. This is a 1% difference from the counterfactual growth rate which was assumed to increase by 4% per annum.

3.4.2 Healthcare effect on labour productivity and total factor productivity
Total factor productivity (TFP) (sometimes referred to as technical change) 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 technical change improvement occurs if sectoral outputs grow faster than inputs. The assumption in the model is that technical change is factor neutral for all sectors which means that all factors’ productivity increases without altering the ratio of the factor’s relative marginal productivity. Empirical studies have shown that investment in healthcare enhances human capital as it improves worker’s productivity by enhancing their physical and mental wellbeing. Using
adult survival rates as a proxy for population health it has been estimated that a 1% increase in adult survival rates increases labour productivity by about 2.8 percent (Bloom & Canning, 2005) which was found to be consistent with the calibrated result of around 1.7% (Weil, 2006). It is also postulated 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).

Furthermore using life expectancy as a proxy for health, it has been shown that 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, (Bloom, Canning, & Graham, 2002). The authors 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. Based on evidence from these studies, and cognizant of the fact that labour input also depends on the presence of other inputs, the healthcare financing reforms are assumed to increase labour productivity by 3% and total factor productivity in all sectors by 3% per year. These rates are introduced in the model as exogenous shocks.

4. Results
The model is configured to capture both the impacts of increasing resources to the health sector and the resulting health effects on the economy-wide labour force, labour productivity and total factor productivity. The results show impacts on factor prices, growth rates in GDP, private consumption, investment, and poverty reduction rates, and distinguished by six different scenarios to highlight the different aspects of the impacts. Scenario 1 is the business-as-usual case which acts as the counterfactual against which the policy simulation results are benchmarked. In this case government consumption expenditure is allocated following the 2008 budget shares and health effects are fixed to the initial year values. Scenario 2 depicts results for the proposed increase in health budget share without the health effects i.e. excluding from the analysis the resulting health effects from additional healthcare expenditure. Scenario 3 depicts results for the proposed increase in the health budget share and includes the envisaged health effects from an expansion in healthcare investments. Scenario 4 compares the counterfactual scenario 1 with the policy intervention that only increases the health budget share without additional health effects. Scenario 5 compares the counterfactual scenario 1 with the policy intervention that increases health budget including health effects. And scenario 6 compares the policy intervention that increases the health budget with and without health effects. It explicitly shows the contribution of the health effects.

4.1 Impact on economy wide factor prices
Figure 1 shows the adjustments in factor prices for three different scenarios. In the CGE model, factor markets clear through relative factor price changes. The factor market closure in the Uganda model
assumed quantity supplied of each factor to be fixed while the economy-wide wage was allowed to vary to assure that the sum of factor demands from all activities equals the quantity of factor supplied. When the economy is left to function with government budget allocation following the 2008 shares wages for all labour categories are predicted to increase by the end of the model period (scenario 1). The unskilled labour category experiences the biggest rise in wage rates - 36.9% while unskilled labour and self-employed wage rates increase by 33.3% and 26.7% respectively. Capital rents increase by a modest 0.2% under the same scenario. On the other hand, when the proposed health budget share is implemented without health effects being included in the analysis (scenario 2), the trend in changes to factor rewards is reversed in contrast to that observed in the business as usual scenario. Skilled labour wages are predicted to double – 101%, reflecting the high demand for skilled labour contributed in part by the expanding skill-intensive health sector. The demand for skilled labour in the expanding public health sector implies less quantity of skilled labour will be available to other sectors and thus creates an upward spiral for skilled wage rates since skilled labour is generally in short supply in Uganda. Capital rents increase by 22% while unskilled and self-employed labour wages increase by only 18% and 15% respectively, in response to the public healthcare service expansion that requires relatively larger input supply. As the health sector expands, it draws units of capital and unskilled labour to combine with the skilled labour to provide the planned expanded service. The expansion by the health sector renders the factor inputs less available to other sectors, which drives up the factor prices.

However, when the proposed health budget share is implemented and the envisaged health effects included in the analysis, factor prices respond differently. Skilled labour wage rates still rise (by 32%) but not to the extent of scenario 2. This is because health sector expansion is assumed to increase healthcare service delivery and thus more “treatments” for all people. Assuming the healthcare output is effective in treating people, a larger output of healthcare (treatments) implies a reduction in the number of people who are ill and unable to work and ultimately healthcare output increase the quantity of effective labour supply and labour productivity of all skills. This also means more effective skilled labour becomes available in the economy and counteracts the soaring wage rates for skilled labour. Wage rates for self-employed rise modestly by 1% while they decline for unskilled labour (by 4%). This reflects the assumption in the model that healthcare expansion leads to increase in labour productivity in all sectors. Since the targeted expansion is in the public (health) service which is inherently skill intensive and that more output can be produced with less labour units, then the marginal jobs between skilled and unskilled labour, formerly held by unskilled labour are likely to be reallocated to the skilled category. Moreover, more units of effective unskilled labour are becoming available from the larger treatment output as well as more children surviving to working

5 For simplicity, assume homogenous health and thus treatment across labour types so that the healthcare output i.e. treatment from the expanded healthcare service delivery positively benefits all labour types.
age and joining the labour market as unskilled labour. These combined effects are bound to increase the quantity of unskilled labour and drive down wage rates for this category.

Figure 1 Changes in economy wide factor returns relative to the initial year values

Note: Scenario 1 = Base budget allocation with base health effects, Scenario 2= Proposed health budget share with no health effects, Scenario3= Proposed health budget share with health effects

4.2 Impact on GDP

Table 1 shows the impact on growth in GDP at market prices, private consumption and investment under the different scenarios. The base budget allocation (scenario 1) predicts a gradual decline in GDP growth rate from 8% in 2009 to 6.7% by 2020. When the proposed health budget share is implemented without including health effects (scenario 2) GDP growth rate is predicted to rise cumulatively from 8.2% to 8.8% by 2020. This reflects the expansion of the health sector as well as expansion in other sectors that are interlinked with the health sector particularly the suppliers of healthcare inputs such as other service sectors and utilities. However, further growth is hampered by the contraction of some sectors such as construction, mining and non-food processing sectors. But the growth rate in GDP is even higher when the proposed health budget share is implemented and health effects included in the analysis (scenario 3). GDP increases cumulatively (at a rate of 9.7% in 2009 to 10.6% by 2020) suggesting that gains from increased labour supply, labour productivity and total factor productivity reinforce the initial increase and fuel further growth. The health treatments are particularly valuable in the primary sectors and the informal sector at large which absorb self-employed and unskilled labour. Consequently the agricultural and food processing sectors expand rapidly, in addition to the service sectors. When compared to the budget allocation in business as usual scenario 1, the contribution of the proposed health budget share in improving the health status of
the population and consequently increasing labour supply, labour productivity and total factor productivity is large as shown in the isolated growth rates in scenarios 5. The proposed health budget share stimulus contributes an additional growth in GDP that increases from 1.7% in 2009 to 3.9% by 2020. Increased labour supply and productivity leads to expansion in the productive sectors such as agriculture and food processing. Excluding the health effects from the analysis evaluating the proposed health budget share underestimates the contribution to GDP growth rate as shown in scenario 6.

4.3 Impact on investment

The result for the impact on investment shows that when base budget allocation is maintained the rate of growth in investment would increase from 0.1% to 0.15% by 2020. On the other hand when the proposed health budget share is implemented without health effects investment would start to decline in 2014 and the rate of decline will reach 1.09% by 2020. However, when the proposed health budget share is implemented and health effects included in the analysis, the onset of a decline in investment is extended to 2016 and by 2020 the rate of decline is predicted to be 0.95%. The decline in investment reflects the reallocation of resources from productive sectors to a non-productive services sector. When government increases the health budget share it reduces resources available for investment in other productive sectors such as road construction and energy. But when the health effects are included in the analysis the adverse effects on investment are reduced to the extent that the rate of investment growth starts to decline in 2013 (scenario 5) as opposed to an immediate decline observed when the health effects are excluded from the analysis (2009 in scenario 2). The timing for the onset of the decline in investment growth shows that the reallocation of resources to the service sector cannot be sustained for long periods as it would hurt the economy. Moreover, the health tax also serves to reduce private savings and investment further compounding the decline in overall investment.
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4.4 Private consumption

Table 1 results also indicate the growth rate in private consumption declining in all scenarios. The growth rate declines from 7.2% to 6.3% under the base budget allocation (scenario 1), 7% to 4.6% under the proposed health budget share without health effects (scenario 2), and 8.4% to 6.5% under the proposed health budget share with health effects (scenario 3). The impact on private consumption from the proposed health budget share reflects the impact of the earmarked health tax on household consumption expenditure as it reduces the disposable income. The imposed tax raises household tax rates to 1.7% for rural farming, 3.9% for rural non-farming, 21.1% for Kampala non-farming, 7.2% for urban farming and 7% for urban non-farming households (table 2). But when the proposed health budget share includes the envisaged health effects, the negative impact of the health tax is reduced as seen in scenario 3 and the contribution of the health effects in scenario 5 (in table 1). The expansion in sectors such as the agriculture, food processing, utilities and services ensures that all labour categories are able to find some form of employment so that all households earn an income and expand their consumption expenditure. Moreover, households with working members benefit from the reduced days of illness and increased well-being rendering them more productive.

Table 2 Impact of the health tax on household tax rates

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<th>Proposed health budget share with health effects Scenario 3</th>
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<td>Urban farming households</td>
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<td>Urban non-farming households</td>
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<td>7.0%</td>
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4.5 Welfare (poverty reduction)

The welfare change in this case 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 2 compares the welfare improvements in terms of national poverty reduction rates for the different scenarios. The reduction in the proportion of people living below the poverty line fluctuates between 7% and 10% under the base budget allocation scenario 1. Similarly poverty reduction rate under the proposed health budget share without health effects is 6 -8% but declines further to only 3% by 2020. This reflects the contraction in the productive sectors such as construction, mining and non-food manufacturing which lay off some categories of labour. When the proposed health budget is
implemented and health effects included in the analysis poverty reduces cumulatively and by 2020 the number of people living below the poverty line is reduced by 34%. This reflects a corresponding expansion of interlinked sectors so that all categories of labour are able to find some form of employment both in the formal and the informal (unregulated) sectors. The Uganda national household survey (UNHS) 2009/10 estimated that 67% of the working persons in the non-agricultural sector were in informal employment. Although the informal sector wages are relatively low, the sector is expanding and absorbing all labour categories that are nevertheless engaged in productive activities and therefore earn income so that households are relatively better off.

Figure 2 Cumulative reductions in proportion of people below the poverty line under the different simulations (%)

Note: Scenario 1 = Base budget allocation with base health effects, Scenario 2= Proposed health budget share with no health effects, Scenario3= Proposed health budget share with health effects

5. Discussion and conclusion
The paper sets out to investigate the macroeconomic impact of healthcare financing reforms in Uganda. Specifically the impact of increasing government resources allocated to the health sector with additional funding from an earmarked tax for health, and the simultaneous improvements in population health are investigated. A recursive dynamic CGE model for Uganda calibrated from the

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6 The informal sector employment in the Ugandan context refers to the unregulated sector. Informal employment identifies persons who are in precarious employment situations irrespective of whether or not the entity for which they work is in the formal or informal sector. Persons in informal employment therefore consist of all those in the informal sector; employees in the formal sector; and persons working in private households who are not entitled to basic benefits such as pension/retirement fund, paid leave, medical benefits, deduction of income tax from wages and whose employment agreement is verbal (Uganda Bureau of Statistics (UBOS), 2010).
Uganda SAM that is augmented with a disaggregated health sector is used to estimate and predict the impact of increasing government healthcare expenditure modelled simultaneously with health effects. The health effects are modelled via an increase in labour supply resulting from the healthcare treating the ill and unable to work labour and from improved general population health which increases child survival rates; and increased labour productivity from improved physical and mental well-being; and total factor productivity from improvements in the labour force health status and increased savings and investments as people expect to live longer.

The wage rate adjustments predicting a decline in unskilled labour wage rates when the proposed health budget share is implemented with health effects included in the analysis are attributed in part, to the improvements in the population health status which ensures an additional labour supply than would otherwise be. All labour becomes more productive so that unskilled labour is substituted away for skilled labour for the marginal jobs. Moreover, health improvements allow more children to survive to working age so that there are new additions to the labour market year on year. Consequently the pool of unskilled labour expands since at 16 years of age (the minimum legal working age) most of them have not gained any credible skills, so that unskilled labour becomes more abundant relative to skilled labour. Therefore, the price for the unskilled labour factor which is becoming more abundant declines while that for self-employed labour which is mainly engaged in the agricultural sector rises slowly, and the price for the relatively scarce skilled labour factor increases.

The depicted GDP growth is best understood by the underlying sector growth rates. Besides the large increases in government health sector there is remarkable growth in other sectors such as agriculture and food processing due to the improvement in the labour force status and increase in labour force supply which boosts agricultural production since 67% of total labour force in Uganda is employed in the primary sectors. This is because the health interventions that lead to higher child survival rates expand the labour force, a direct benefit to the primary sectors since for every 100 new workers 67 of them will get to work in agriculture, forestry, fishing, and quarrying 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.

Further still, the proposed health budget share 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

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7 Primary sectors are synonymous with the agricultural sector in this study which comprises of crop and animal farming, fishing and forestry (UBOS, Statistical Abstract 2012).
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 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.

Investment is observed to decline mainly due to the contraction in the mining and construction sectors observed in all scenarios. This is because increased public healthcare expenditure is service oriented and tends to draw resources away from the construction oriented sectors such as the energy and road construction sectors. Additionally the private sector investment capabilities have been reduced by the imposed tax on households yet the private sector plays a significant role in investment. In this instance, government increase in healthcare expenditure crowds out private investment, particularly in construction. Although the inclusion of health effects reduces the adverse impact on investment it is noted that it nevertheless starts to decline. This suggests that a continuous reallocation of resources to the service oriented sectors is not sustainable in the long run. Consideration should be made for investing in enabling infrastructure for sustainable growth.

The tax proposal on households is progressive as observed from the resultant tax rates for the different households. It places a proportionately bigger burden of healthcare financing on higher income households compared to lower income households and provides an opportunity for government to raise tax revenue from the large informal sector which to date remains untaxed. The observed progressivity of the proposed health tax resonates with similar findings of progressive tax on income for additional revenue to fund healthcare in South Africa and Tanzania. In South Africa a universal health coverage system financed from general tax revenue with an additional tax in form of a progressive surcharge on taxable income was found to be the most progressive healthcare financing system among the various scenarios considered (Di McIntyre & Ataguba, 2012). In Tanzania the study found that imposing an income tax on segments of the informal sector would provide additional funding for healthcare in a progressive way (Borgi, Mtei, & Ally, 2012). The policy implication is that earmarked taxes for healthcare are a sufficient and sustainable source of fiscal space for health in Uganda. However, it should be noted that tax matters are largely of a political nature and the intricacies of taxing the informal sector should not be under estimated.

A sensitivity analysis has shown that results are sensitive to health effects. This implies that model results are specific to a particular country setting with variations depending on effectiveness of healthcare in treating and curing the unwell. The parameter values for health effects were obtained
from literature and assumptions made explicitly. It is recommended that further research be carried out in Uganda to determine the effectiveness of healthcare in improving the population’s health status on one hand and the change in health status brought about by additional funding for healthcare on the other. This research will then provide the parameter values that are critical in estimating the economy-wide impact of additional healthcare funding coupled with health effects.

References


Kivumbi, G. W., & Kintu, F. (2002). Exemptions and waivers from cost sharing: ineffective safety nets in decentralized districts in Uganda. (Health sector reform and equity - learning from evidence?). Health Policy and Planning, 17(Supplement), 64-71. doi: http://dx.doi.org/10.1093/heapol/17.suppl_1.64


