

The macroeconomic implications of COVID-19 pandemic and associated policies: An economy-wide analysis of Uganda

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Abstract

This study evaluates the economy-wide impact of Covid-19 pandemic and associated mitigation policies in Uganda, a developing country where over 20% of its 40 million live on less than \$2 a day. Uganda instituted Covid-19 pandemic mitigating strategies ranging from home/institutional quarantine to social distancing of entire the population where all households reduced contact outside their household. The mitigating strategies result in economic consequences with some sectors being affected more than others. We employ a recursive dynamic computable general equilibrium model to evaluate the aggregate impact of Covid-19 on the Ugandan economy. Specifically, we design scenarios to mimic the impact of mortality, morbidity and mitigating public health policies on the economy, focussing on impact channels via labour supply, labour productivity, government health spending and remittance inflows. Results indicate that growth in sector output declines for many of the sectors under all scenarios except for the increase in non-tertiary rural labour scenario. The increased government health spending induces expansion in the healthcare output but the sectors that produce the intermediate inputs for healthcare production do not grow in tandem. This suggests the healthcare inputs are largely imported. There is an increase export growth rates when we assume an increase in supply of non-tertiary rural labour, suggesting that agricultural products exported to neighbouring countries through informal channels persist even during the Covid-19 restrictions. The sector performance results call for policymakers to revisit Uganda's industrial policy and reorient it towards domestic production of commodities that are intermediate inputs to critical domestic sectors such as healthcare. Additionally, there is a need to accelerate rural infrastructure development particularly the road network, to facilitate an integrated rural economy induced by the shift in labour and enterprise towards rural areas. The results on welfare effects show that a reduction in remittance inflows is predicted to generate the most decline in welfare. The government should consider transfers to households to mitigate the adverse effects of Covid-19 particularly for remittance recipient households.

Key words: Infectious diseases; Covid-19; Healthcare; Economic growth; Computable General Equilibrium modelling; Uganda

(GTAP keywords: Dynamic modelling, Economic growth, Health, Africa (East))

JEL classification: D580, I130, 011

1. Introduction

This study aims to evaluate the economy-wide impact of Covid-19 pandemic and associated mitigation policies. Corona virus (Covid-19), was first confirmed in Wuhan city of Hubei province China on 3 December 2019 (Wu and McGoogan, 2020). It quickly spread to other parts of the world and was declared a Public Health Emergency of International Concern (PHEIC) on 11 January 2020. The lack of a known cure currently implies preventive measures must be in place to limit infection from the disease. Data from China showed that human-to-human transmission is the main mode of Covid-19 transmission, in both community and hospital settings, and the transmitters may be asymptomatic or with mild symptoms (Wang et al., 2020). Using the SIR –susceptible (S), infected (I) and recovered (R) epidemiology model, it has been possible to understand the course of an epidemic and to plan effective control strategies (Kermack and McKendrick, 1927). The key parameter is the reproduction number R_0 i.e. the average number of infected people per one contagious person: $R_0 > 1$ implies the virus is spreading fast and rate of infection is growing exponentially. However, as people recover the population gains immunity, eventually $R_0 < 1$ and the virus dies out¹. The key challenge for the health sector is to influence R_0 i.e. design measures to both contain and suppress the virus.

The international health regulations (IHR 2005) require that countries undertake mitigation responses within IHR provisions of risk assessment and risk communication to ensure appropriate response globally (World Health Organization, 2008). Several countries, including Uganda instituted variations of Covid-19 pandemic mitigating strategies ranging from case isolation in the home, home/institutional quarantine to social distancing of entire population where all households reduce contact outside their household. The disease and pandemic mitigating strategies generate economic consequences including impact on travel services, hospitality services, durables expenditure, and on the supply chain. Some sectors have been affected more than others have; the current news reports tourism and hospitality, aviation/airlines, automotive, consumer products, and consumer electronics among the most affected sectors. However, the list may vary from country to country depending on, among others, the structure of the economy.

¹ If $R_0 < 1$ it implies the speed of recovery is higher than the speed of contagion, thus the virus dies out.

Studies that have investigated the economic impact of infectious disease pandemics tend to focus on the direct effects of the pandemic such as illnesses, deaths, hospitalisations, and direct effects of mitigation strategies such as cost-effectiveness analyses of vaccinations, business losses from reduced consumption and workforce absenteeism, among others (Berry et al., 2018; Meltzer et al., 1999; Sander et al., 2009). For example, a public risk management model was designed to examine the economically optimal investment capacity needed to reduce the likelihood and severity of the Ebola pandemic of 2014 (Berry et al., 2018). They defined the economic costs to include human health expenditures, and lost productivity and commerce, and demonstrated that it is beneficial to invest in prevention and protection by maintaining a capital stock –hospitals, lab facilities and equipment, surveillance networks and knowledge and human capital, which lasts for a long-term. However, the analysis focuses on the health system while disregarding the interaction of the health sector with other sectors in the economy. Similarly, a study estimated the economic impact of influenza pandemic mitigation strategies taking a societal perspective to account for productivity losses due to prophylactic absenteeism and school closure disruptions (Sander et al., 2009). However, they did not analyse the economy-wide implications of productivity losses such as the impact on welfare.

Overall, the approach to analyse only direct effects takes a narrow focus, a partial equilibrium, which does not capture the indirect effects of both the disease and the mitigating policies on the wider economy. A typical partial equilibrium analysis is ill-equipped to estimate the cascade effects resulting from certain public health policy interventions (Beutels 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 whole economy of various policy interventions.

Some studies have evaluated the economic impact of infectious disease pandemics using the CGE modelling approach majority of which are set in developed countries. Applying a single country static CGE model of the UK, studies evaluated the economy-wide impacts of pandemic influenza on the UK economy (Richard D Smith et al., 2011; Richard D Smith et al., 2009). They postulated that both the quantity and productivity of labour reduced by illness and deaths due to the disease and that mitigation policies may reduce available labour if people are advised to keep away from work to avoid infections. Results showed that the major loss to the economy

arises from the courses taken to mitigate the disease, such as school closures and prophylactic absenteeism, which reduce labour supply to the economy. However, they do not show the economic impact disaggregated by sectors. Sectors that are less people-oriented are likely to have relatively lower impact when compared to the labour-intensive sectors. Nevertheless, another study, using the single country static CGE model applied to the UK, France, Belgium and Netherlands, with disaggregated sectors, evaluated the impact of a pandemic influenza and obtained estimates similar to the UK study (Keogh-Brown et al., 2010; Richard D Smith et al., 2009). These studies also indicated that the greatest concern for an episode of pandemic influenza is the resultant mitigation policies such as school closures and prophylactic absenteeism that lead to colossal sums of money lost in declining outputs for the economy.

The foregoing studies employ a static CGE model and highlight the short-term effects; they do not capture the long-term effects of the pandemic and mitigating factors on the economy. We propose to overcome this shortcoming by employing a dynamic recursive CGE model. A dynamic model is a more suitable alternative because health effects and associated policies in the wider economy may have long-term lags. It also generates an evolution path of the economic system from the initial to the final state, thus capturing the costs associated with the adjustment to changes in the public health policies. We also model labour disaggregated by skill and residence, to isolate the differential impact on labour-skill intensiveness in specific sectors. One of the few studies evaluating developing country economies applied a static CGE to Thailand, South Africa, and Uganda and showed sectoral impacts that differed across countries, depicting the differences in the structure of the economies under study (Richard D. Smith and Keogh-Brown, 2013). Furthermore, our proposed study setting in developing countries of Africa differentiates it from the dynamic CGE model used to evaluate the macroeconomic effects of H1N1 Influenza pandemic in Australia, a developed country (Verikios et al., 2010).

Our study aims to examine the economy-wide impact of Covid-19 pandemic and associated mitigation strategies on the Uganda economy using a dynamic computable general equilibrium analytical approach. Specific objectives are threefold. First, to design model scenarios to mimic the impact of mitigating public health policies on the economy focussing on impact channels via labour supply, labour productivity, government health expenditure with fixed government budget and with foreign aid for health, and remittance inflows. Second, to evaluate the aggregate impact of Covid-19 on sector production and GDP growth, international flows via

imports and exports, and household welfare. Third, to recommend policy options to minimise the impact of infectious disease pandemics in Uganda and similar low-income countries.

Our study contributes to the literature on the economy-wide impact of infectious diseases. The proposed economy-wide analytical approach is a move from the narrow internal focus on the health sector to wider national effects. The dynamic CGE model with highly disaggregated sectors, households, and labour, has scarcely been applied in a macroeconomic assessment of infectious pandemics in a developing country setting. Existence of a large informal (unregulated) sector that is also a significant employer in Uganda, for example, has implications for the wages structure, sector output composition as well as household income and poverty rates in the country. The Ugandan CGE model captures these effects. This study confers lessons to other developing countries with similar economic structure like Uganda, on the economy wide effects of infectious disease pandemics and mitigation strategies.

2. Background

2.1 Social economic characteristics of Uganda

Uganda is a landlocked country within the Great Lakes region of East Africa. With an estimated area of 241,550.7 square kilometres, the country is home to 44.3 million people with a per capita income of \$795 (current USD) and an age dependency ratio² at 94% (World Bank WDI 2020). At 94%, Uganda is in the top ten countries with the highest age-dependency ratio in the world. The urban population share stood at 24% (as of 2019) having grown rapidly in the past twenty years as a result of gazetting new urban areas (Town Councils and Municipalities) for newly created districts (Uganda Bureau of Statistics, 2020). Many of the Town Councils and Municipalities in the new districts remain rural in every sense because the exercise aimed to increase political patronage for the ruling party rather than devolving governance for improved service delivery; there has not been any direct correlation between the newly created districts and improved services delivery (Ayeko-Kümmeth, 2014).

² **Age dependency ratio (% of working-age population).** Age dependency ratio is the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population (World Bank WDI, 2020).

The primary sector activities of agriculture, forestry and fishing are the major employers in the economy –employing approximately 65% of the total population, although they contribute less than a third of total GDP: 24% compared to 26.2% for industry, 43% for services and 6.8% in taxes on products in 2019/2020 (Uganda Bureau of Statistics, 2020). Persons in paid employment (wage and salaried workers) constitute 38.1% of total persons in employment compared to 49.9% in “own account workers”, 6.9% in “contributing family worker”, 4.4% in “employer” and 0.7% in “other” categories (Uganda Bureau of Statistics, 2020). Half of the employment in the primary sector is “own account worker” and only 35.7% is “paid employment” compared to 56.6% in services and 7.9% in industry. Overall, the informal sector employs 84.9 percent of the population, 90% of whom are youth (10-30 years) (UBOS, National labour force survey (2016/17)). The country’s economic structure poses a big challenge when it comes to navigating the impact of Covid-19.

2.2 Covid-19 in Uganda

Although the first and only case of Covid-19 detected in Uganda was on 20th March 2020, the President had issued directives for Covid-19 restrictions on the 18th March and by end March 2020 the directives had culminated into a total country lockdown. The directives included closure of borders with some countries, travel ban for international passengers while land and air cargo had to follow strict guidelines. Domestic travel restrictions included a dusk to dawn curfew and a ban on public and private transport except for essential transporters such as food trucks. Schools and all other education institutions closed and a suspension of social, cultural, and religious gatherings of any form enforced. All business operations that were categorised as non-essential and non-food markets closed. Covid-19 restrictions were eased in June 2020, but schools and learning institutions remained closed and only allowed to open in January 2021 in a staggered manner, each year group being in a face to face class for at least four weeks and vacating before another group reports. Unfortunately, the second wave of Covid-19 that is sweeping the country since May 2021 has forced the total closure of learning institutions again before some of the year groups could have their turn in class, and imposed restriction on inter-district travel while still maintaining some of the earlier directives such as the dusk to dawn curfew.

3. Methodology

3.1 Model description

We examine the economic impact of the disease and associated policies using a single country recursive dynamic computable general equilibrium (CGE) model of Uganda. A CGE model is a set of mathematical equations specifying the economy in terms of agents –households, firms/producers, the government, and the rest of the world. Each agent has different resources and behaves differently from the other agents. For example, households are the consumers in the economy, they work for firms and receive wages in return for their labour, and they spend their wages on purchasing goods and services and save any remainder. In deciding which goods to buy or saving to make, households choose those combinations that give them the most satisfaction (utility) within the constraints of their budget (income). In the model, each household allocates their disposable income to consumption by maximizing a Stone-Geary utility function under a linear expenditure system. The firms (producers) purchase labour from the households and combine it with capital and land (which they also buy) to produce goods and services. Firms choose how much of a good they produce by minimising the cost of production whilst maximising their sales because they want the biggest possible profit. The model assumes perfectly competitive markets and constant returns to scale production functions. The government collects taxes from wages by households and sales by firms and then spends the money around the economy on public services such as healthcare, subsidies and benefits.

The macroeconomic closures are defined as follows. For the government closure we assume flexible government savings while all taxes and real government consumption are fixed. Additionally, within the government expenditure equation, we fix the government function (commodity consumption) demand scaling factor while the government function shares and transfers are endogenously determined to allow for modelling the increase in the health sector budget due to Covid-19 induced demand. To align with this government function closure, we assume a savings driven savings-investment balance so that the households' and enterprises' marginal propensities to save are fixed and real investment expenditure adjusts to equal the volume of savings available to finance it. For the external balance, foreign savings are kept constant while the real exchange rate is flexible to clear foreign exchange markets. This closure allows us to model an increase in aid inflows for Covid-19 interventions. In the factor markets, labour supply is fixed, and the real wage adjusts to equate demand and supply.

The CGE modelling finds a solution where all these behaviours are satisfied (and optimised) simultaneously. The solution of the model represents an economy in equilibrium. The recursive dynamic feature implies that the within-period equilibrium for a given period forms the baseline for the next period model run and the process continues for the entire model horizon. In each iteration, investment of the current period is turned into capital stock of the next period and exogenously provided factor supply and productivity growth rates determine the overall growth of the economy.

3.2 Social accounting matrix (SAM)

A CGE model is calibrated from a social accounting matrix –a comprehensive, economy-wide data framework representing the economy by capturing the financial value of transactions and transfers between all economic agents in the system, for a given period. The latest Uganda SAM for the baseline calibration is readily available (Randriamamonjy and Thurlow, 2016). It is a Nexus SAM with 58 sectors in a 122 by 122 matrix, representing activities (entities that carry out production) and commodities (markets for goods and non-factor services); factors of production; the government; domestic non-government institutions (households and enterprises) and the rest of world (external sector). The matrix columns represent payments and rows are receipts, as in the accounting double entry format.

The Nexus SAM2013 is a one to one mapping of activities and commodities. Our value addition is in transforming the Nexus SAM into a SAM suitable for calibrating the dynamic CGE model to achieve the study objectives. We aggregate the N58 micro SAM into a Macro SAM as follows. The sector/commodity mapping in the micro SAM is aggregated into three main sectors of agriculture, industry, and services, as shown in Table 1, purposefully done to aid the analysis of targeted policy simulations. Agriculture includes food and cash crops, and livestock farming; industry includes food processing and other manufacturing; and in services, Other private services includes Accommodation and food services, Information and communication, Finance and insurance, Real estate activities, and Business services while Other services includes both public and private services not listed elsewhere.

For factors of production, we maintain the disaggregation in the micro SAM -labour disaggregated by residence (rural/urban) and by level of education (uneducated, primary, secondary, and tertiary). This classification is important because different policies will affect

different categories of labour differently. For example, closure of universities is likely to affect the urban tertiary level workers more than the urban uneducated workers. Similarly, we maintain the household categories in the micro SAM –by residence (urban/rural) and by income quintile, again for identifying the extent to which each household category is impacted by the different policies and mitigation strategies. We balance the SAM using the PEP SAMBAL SAM balancing program solved in GAMS (Lemelin et al., 2013).

Table 1: Classification and aggregations from the Uganda SAM2013

Sectors/commodities	Factors	Households
Agriculture	Labour	Rural farm - quintile 1
Agriculture	Labour - rural uneducated	Rural farm - quintile 2
Forestry	Labour - rural primary	Rural farm - quintile 3
Fishing	Labour - rural secondary	Rural farm - quintile 4
Industry	Labour - rural tertiary	Rural farm - quintile 5
Other mining	Labour - urban uneducated	Rural nonfarm - quintile 1
Meat, fish and dairy	Labour - urban primary	Rural nonfarm - quintile 2
Fruit and vegetable processing	Labour - urban secondary	Rural nonfarm - quintile 3
Fats and oils	Labour - urban tertiary	Rural nonfarm - quintile 4
Grain milling	Land	Rural nonfarm - quintile 5
Sugar refining	Land - agricultural crops	Urban - quintile 1
Other foods	Capital	Urban - quintile 2
Beverages	Capital - crops	Urban - quintile 3
other manufacturing	Capital - livestock	Urban - quintile 4
Chemicals	Capital - mining	Urban - quintile 5
Machinery and equipment	Capital - other	
Utilities		
Construction		
Services		
Wholesale and retail trade		
Transport and storage		
Other private services		
Public administration		
Education		
Health and social work		
Other services		

Source: Authors' derivations from the Uganda SAM2013

3.3 Simulations design for the impact of Covid-19

We design a set of scenarios to reflect the impact of Covid-19 pandemic. For the burden of disease impact, two main channels normally considered are: death (mortality), which

permanently removes sections of the labour force (case fatality ratio), and illness (morbidity), which temporarily removes sections of the labour force (clinical attack rate). However, in line with the studies alluded to in the literature section, we consider the fact that the greatest impact of the pandemic arises from mitigation policies rather than death or illness from the disease. For instance, according to the data record on 3rd March 2021 by Johns Hopkins University, Uganda had only 40,395 confirmed cases and 334 deaths, with a case fatality ratio of 0.8% translating to 0.78 deaths per 100,000 population. Similarly, Bell et al predicted Uganda to have a low disease burden (mortality and morbidity) from Covid-19, based on the country's population age structure, but warned of a high risk of an increase in non-Covid-19 disease burden as a result of prolonged lockdown and other restrictions (Bell et al., 2020). Therefore, we concentrate on designing scenarios for the pandemic mitigation strategies both at the domestic and international level. At the local level we consider the Presidential directives on Covid-19 and their effect via labour supply, labour productivity and government spending on healthcare. The directives included closure of schools, colleges and universities, closure of all non-essential businesses and service providers, suspension of public transport, closure of airports to passenger carriers, and closure of leisure and entertainment venues. On the healthcare front, actions included the increase in capacity of some government hospitals to cater for critical care and setting up case isolation centres in different parts of the country and later on set up vaccination centres. The degree of restriction for some of the measures was relaxed after about six months, under strict standing operating procedures (SoPs) but later reinstated when the second wave, with the more virulent Delta variant, set in during May 2021. At the international level, we consider the impact on remittance inflows.

3.3.1 The baseline growth path: No covid-19 scenario

The baseline scenario depicts how the economy would perform in the absence of Covid-19 effects, for the period 2019 to 2030. The beginning of the model horizon is selected to coincide with the initial year of the onset of the Covid-19 pandemic in Uganda. Additionally, the SAM coefficients in the Nexus SAM2013, the benchmark dataset, are assumed to be consistent with the performance of the economy as of 2019. The effects of Covid-19 pandemic and containment policies are measured against the baseline as the benchmark. The calibrated capital growth rate for the dynamic baseline scenario is set to 5%, to generate a GDP growth rate of 5.6%, that is consistent with the IMF Economic Outlook. The IMF growth forecast, accounting for the Covid-19 effects, will fluctuate between 5% and 6.4% for the period 2020 to 2025, a decline from the 7.5% growth realised in 2019, and we assumed it remains in that region up to

2030. This baseline GDP growth is achieved with 1% annual growth rate in labour productivity and total factor productivity.

Aggregate government consumption expenditure and foreign savings are each set to grow at 3% per annum, taking the average growth in the trend depicted in the national accounts for the past decade (Uganda Bureau of Statistics, 2020). The government consumption shares by function takes the average values derived from the trend in actual expenditure share for financial year 2015/16 to 2019/20 (Uganda Bureau of Statistics, 2020). Annual change in labour supply is set at 4%, in line with the UN demographic model for Uganda. Growth in remittance inflows is set 10% per annum, according to the average annual increase for the past twenty years (Cooper et al., 2018).

3.3.2 Labour supply

Different labour types are affected differently by the lockdown policies. Whereas remote working became quite attractive, it poses serious challenges to employers and is hardly feasible for informal sector workers³ who are the majority in Uganda. Even for the 17.9% formal sector workers with access to technology and capable of applying the digital tools, the proportion that can work from home varies by sector and occupation. Many workers in retail, leisure, construction and manufacturing can hardly work from home. Additionally, the concept of remote working is relatively new in Uganda; it poses challenges for worker productivity because workers are accustomed to working in proximity of their employers/supervisors, let alone the lack of required IT equipment, slow or no internet access and intermittent electricity supply.

Using data from the Uganda High-frequency Phone Survey on COVID-19, conducted by Uganda Bureau of Statistics in June of 2020, a study found that 45% of adult men and 49% of adult women did not work in the week preceding the survey, due to Covid-19 restrictions (Mukoki et al., 2020). Additionally, a research team that was studying the economic status of households in 21 parishes from two rural districts in Western Uganda, prior to the Covid-19

³ Persons in informal sector employment are normally in precarious employment situations, not entitled to basic benefits such as pension/retirement fund, paid leave, medical benefits and often their employment agreement is verbal.

lockdown, conducted a follow-up survey in May 2020⁴ to establish the impact of the lockdown on economic outcomes and wellbeing (Mahmuda and Riley, 2021). They found a 50% decline in wage and salaried labour supplied by households, and household labour supplied to their enterprises. However, they also found a reallocation of labour towards crop and livestock farming and an overall increase in the time allocated to these activities by nearly 100% on the baseline mean. This suggests the lockdown could have induced households to devote time to farm activities both for subsistence and for income since income generating opportunities outside the homesteads had drastically reduced. The farming labour dynamics revealed in this survey are a typical representation of rural communities throughout the country because these areas experience similar weather patterns and seasonality of crop and livestock farming.

We model the labour supply shock as follows. First, we assume an increase in the labour supply in the rural-based primary activities of agriculture, forestry, and fishing. Thus, we increase the initial rural non-tertiary labour by 50% in the first year. This increase is then reverted to 20% in the subsequent year, and finally remains at 10% above the initial level up to 2030 (subject to the 4% annual labour growth rate in the baseline). This scenario assumes that some workers will be returning to their former occupations in the aftermath of Covid-19 restrictions while some will remain in the new-found activities of farming. Second, we assume a decline in labour supply for predominantly urban-based enterprise sector activities including wholesale and retail, transport and storage, and other private services, largely in the informal sector. Thus, we reduce the initial stock of urban non-tertiary labour by 80%. This reduction is then reverted to 50% in the subsequent year, then to 20% in next year, then remains at 10% below the initial level up to 2030 (subject to the annual labour growth rate). These labour adjustments are based on the assumption that some workers will not return to their jobs as some businesses downsized while others went bust due to Covid-19 restrictions⁵ (Lakuma et al., 2020).

3.3.3 Labour productivity

The physical and mental wellbeing of workers is pertinent to their performance at work. Wellbeing and worker productivity are inextricably linked. Mahmud and Riley (2021) also found an increase in depression and low well-being among the respondents in the Western

⁴ The first easing of Lockdown restrictions started in June 2020

⁵ The Economic Policy Research Centre rapid survey of businesses revealed that business activity reduced by more than 50% and 75% of the surveyed businesses laid off workers due to Covid pandemic risks and associated restrictions (Lakuma et al 2020).

districts of Uganda. Additionally, disruptions in teaching and learning programs at schools and training institutions implies that acquisition of skills is negatively impacted. This will potentially affect progress in human capital accumulation, both in the short and medium term (World Bank, 2021). Consequently, labour productivity levels will decline in tandem. We therefore model a labour productivity shock in all sectors of the economy by assuming a gradual decline, with the largest shock in the first year, which reduces in subsequent years as people become accustomed to the new normal of living and working, thereby making necessary adjustments. We assume the initial labour productivity declines by 10%, then this decline reverts to 5% in the subsequent year and finally to 2.5% per year until 2030. The decline is partly attributed to reduced population well-being, reassignment of tasks from those usually performed e.g. the reallocation of labour to farm activities as discussed above as well as inadequate skills acquisition due to Covid-19 disruptions.

3.3.4 Remittance inflows

Impact of reduced remittance inflows to Uganda due to Covid-19 effects in source countries. The World Bank predicted remittances to Sub-Saharan Africa to fall and that the declining trend would continue in subsequent years (World Bank, 2020). We assume that the declining trend would gradually level off by 2030, following the anticipated economic recovery in migrant host countries but may not be completely restored to pre-Covid-19 levels. Thus, we shock the model with a reduction in remittances by 80% from the initial year, then this reduction is reverted to 50% in the subsequent year and finally to 10% for all years up to 2030.

3.3.5 Increase in the health sector spending (fixed resource envelope)

This scenario assumes the government has a fixed resource envelope from which to fund additional healthcare expenditure arising from Covid-19 effects. There is no taxation increase earmarked for this additional health spending but rather, the general tax revenue follows the same path as in the baseline. With a fixed budget, such additional spending in the health sector is drawn from other government functions such as the public administration sector⁶. We assume the health sector budget share doubles in the first year, then this increase is reverted to 50% in 2022 and finally to 30% for the years up to 2030.

⁶ The public administration sector in the SAM comprises of all those government functions in the national accounts, other than health i.e Public admin = General public services, Defence, Public order, Economic affairs, Environment, Housing and community affairs, and Social protection.

3.3.6 Increase in health sector budget allocation: external resources

This scenario assumes the same health sector spending increase patterns as the previous scenario but also that the government can mobilise additional resources from external sources for funding healthcare activities in the wake of Covid-19. Therefore, the health sector budget share increases but additional resources are drawn from aid for health in the form of transfers from the rest of world to government, specifically directed to the health sector. We assume that the foreign aid flows beyond the baseline rate are deployed in the health sector according to the Covid-19-induced priorities. Although part of the foreign aid inflow may be in the form of concessional loans, such that they carry an implication for interest payments, the current model does not distinguish between foreign aid inflows that are concessional loans or grants. Our analysis is limited to assessing the Covid-19-induced health spending with increased external resources, assuming that a positive impact could outweigh the cost of interest payments on the economy. We thus define a health-aid multiplier while maintaining the same pattern of increase in health spending as in the preceding simulation experiment five (i.e. where the health spending increases in a fixed government budget).

Table 2 Summary of simulations design

Scenario	Description	Parameter
Base	Baseline growth path	
EXP1	Non-tertiary rural labour increases	LFGR
EXP2	Non-tertiary urban labour declines	LFGR
EXP3	Decline in labour productivity growth in all sectors	FPRDGR
EXP4	Reduction in remittance inflows	TRNSFRGR (H, ROW)
EXP5	Increase in government health spending (fixed budget)	QGGR (GOVF)
EXP6	Increase in health spending with Foreign aid for health	QGGR (GOVF) TRNSFRGR (GOV, ROW)

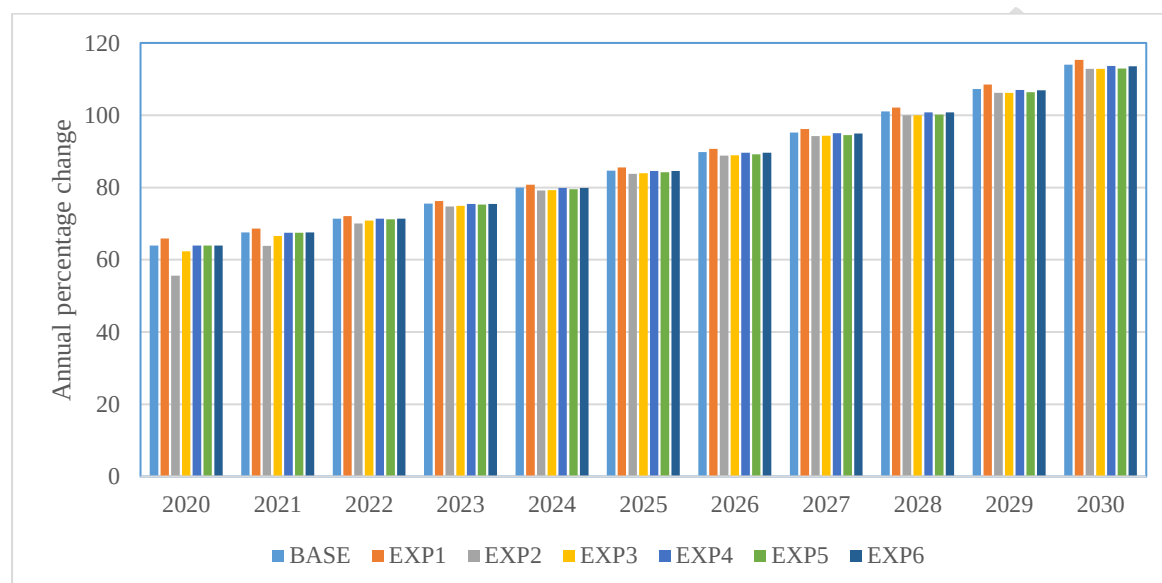
4. Results and discussion

In CGE modelling, the emphasis of the simulation result is on the direction (sign) of the effect of a shock in the economy, as opposed to the magnitude of the effect. We thus present results as deviations from the baseline, at the intermediate and aggregate levels of the economy.

4.1 Sector performance

The country experiences some growth under each of the scenarios, as seen in Figure 1 which illustrates the trend in GDP at factor cost from 2019 to 2030. However, we are interested in understanding whether Covid-19 had an impact on the growth rates when compared to the baseline growth path. Thus, Table 3 reports the deviation from the baseline for annual sectoral GDP growth rates under the different scenarios.

Figure 1 Growth in GDP at factor cost: 2020 to 2030 (% change)



Data source: CGE modelling results

From Table 3, we observe that the Covid-19 impact scenarios generate negative growth rates in output for majority of the sectors, except for the labour supply shock which increases rural non-tertiary labour. As economic activity shifted to rural areas during the Covid-19 lockdowns, there emerged an increase in demand for labour to work on farms and other rural-based activities (see Appendix Table A4). At the same time, people flock to rural areas where the cost of living is relatively cheaper when compared to life in urban centres during Covid-19 lockdown. Majority of those flocking rural areas are informal sector workers with non-tertiary education. They thus drive down wage rates for this category of labour despite the increase in demand. The labour supply and demand dynamics generate negative growth rates in wage rates for non-tertiary rural labour when compared to the baseline, as shown in Table 4. This shock generates growth rates in all sectors, as shown in Table 3.

Although all types of labour are relatively cheap compared to the baseline, as shown by the growth rate in the economywide wage, Table 4, when combined with the other shocks the

sector output growth rates shown in Table 3 suggest that availability of cheap labour alone, particularly non-tertiary rural labour, is not sufficient to spur growth in all sectors beyond the baseline rates. The lack of commensurate growth in sector output is partly due to the underdeveloped physical infrastructure networks, such as poor rural road networks needed to facilitate easy movement of goods to markets, lack of processing and storage facilities that could preserve the abundant seasonal harvest to be sold in times of scarcity, limited rural electrification to facilitate business activities including agricultural processing, among others. For example, up to 90% of the transport sector is dependent on the road network yet only 3.2% of the total road network (about 146,000km) is paved, mainly in cities and urban centres (Ministry of Works and Transport (Uganda), 2018). Yet evidence shows that the stock of infrastructure assets is positively associated with economic growth (Calderón and Servén, 2004) and the productivity effects of transport infrastructure tend to be higher for roads (Melo et al., 2013). It is therefore important to augment the growth in production factors such as labour and land, with accelerated investment in rural infrastructure, so that producers and consumers are better integrated into national and international markets, hence generate faster economic growth.

Additionally, when urban-non-tertiary labour supply declines, the observed negative growth in the majority of sectors is consistent with the effect of a reduction in aggregate demand. This is because the urban workers operate a more cash-based (monetised) economy, when compared to their rural counterparts who survive on subsistence from their gardens, hence are a source of regular demand for goods and services produced by all the sectors. A reduction in the growth rate of urban labour implies a decline in their labour income and potentially declining consumption expenditure. The cut-back in consumption expenditure implies stockpiles of goods in retail and wholesale shops, and ultimately in the manufacturers' warehouses. Consequently, firms will cut back on production of more goods.

Notable among the sector performance is the machinery and equipment sector whose growth rate rises by 1.02 percent points under the reduction in remittances scenario. This suggests that the Covid-19-induced shift in how people live and work, potentially generates increased demand for machinery and equipment such as electrical and computer accessories, for example for online learning and working from home, as well as farming tools and equipment to combine with the additional farming labour. Moreover, the biggest demanders of the machinery and equipment commodity are households in the fifth quintile of the population with the highest

household incomes, in both rural and urban areas (see Appendix Table A3). These households are more likely to purchase equipment to suit the changes in lifestyles induced by Covid-19 restrictions. The contraction in other sectors under the same scenario can be explained by the negative impact of reduced remittances on consumption expenditure. Majority of households that receive remittances deploy that non-labour income to immediate expenditure demands including out-of-pocket payments for healthcare, education, and household consumption goods (Amega, 2018; Doyle, 2015; Medina and Cardona, 2010). This implies a reduction in remittance income reduces consumption expenditure which potentially leads to a decline in aggregate demand. This, in turn, feeds back to the sectors that supply the goods and services, and limits growth in output produced.

Furthermore, increasing government health spending generates a decline in growth rates for most sectors, when compared to the baseline although some of those sectors become better off when the source of government health funding is external resources. The decline in sector output growth is partly due to the expanding public healthcare expenditure which reduces resources available to other government functions. A reduction in other government functional expenditures affects some of the sectors which are more directly interlinked with the rest of the economy. For example, from the SAM, the public administration sector consumes 1.8% of the construction sector commodity compared to 0.25% consumption by the health sector, and the construction sector contributes 9.5% to GDP compared to 3.4% contribution by the health sector.

However, an increase in public health spending implies an expansion in the production of healthcare services since the government is both the producer and consumer of public healthcare. This expansion would require additional healthcare production inputs such as healthcare workers, medicines, and other health commodities. It is interesting to note however, that even for those commodities with large intermediate input shares in the production of a unit of healthcare, (i.e. SAM shares for other manufacturing: 0.17 and chemicals: 0.16), expanding the health sector production does not generate commensurate growth in the domestic sectors that could produce such commodities. This suggests that these commodities are largely imported, which is plausible because only a small proportion of medicines and medical commodities are produced locally in Uganda (UNIDO, 2010) and no Covid-19 vaccine is produced in Uganda. The result demonstrates that the economy exhibits limited supply capacity by local manufacturing sectors; they are unable to meet the demand for critical healthcare

production inputs commodities when the health sector expands. This calls for a reorientation of the country's industry policy towards manufacturing of products for which potential demand exists such as medicines and medical commodities.

We also notice that expanding the skill-intensive health sector, through increase government health spending, generates increased demand for skilled labour, as shown by the results for the growth in quantity demanded of labour by sector (see Appendix Table A4). When compared to the baseline, the health sector demand for labour grows by 0.52 and 0.44 percent points for rural and urban tertiary-labour respectively. The increased demand also generates an increase in the wage rate for this category of labour (see Table 4) partly because healthcare labour requires skills that take a long to acquire and therefore it is not likely to increase the pool of healthcare workers in the short run yet there is growing demand. Overall, the health sector GDP grows by 0.54 – 0.58 percent points while other sectors shrink or remain at baseline levels, except for public administration. This result is consistent with the theoretical factor-bias effect of expanding a non-tradable sector in a Heckscher-Ohlin (H-O) model of production equilibrium, extended to incorporate health and healthcare (Kabajulizi, 2016). According to this theory, given a fixed endowment of skilled and unskilled labour, expanding the skill-intensive non-tradable health sector will draw more units of the available skilled labour and some unskilled labour into the production of healthcare, resulting into a decline in the skilled to unskilled labour ratio in the rest of the economy. Consequently, while the health sector output expands, the output of other skill-intensive tradable sectors such as construction, manufacturing, and machinery and equipment will decline while the tradable sectors intensive in unskilled labour will grow slowly. The theory suggests that in settings where skilled labour is scarce, such as Uganda, expanding the health sector may lead to a decline in overall output because the skill intensive sectors' output declines while that of unskilled intensity grows slowly⁷.

⁷ This factor-bias outcome is, however, only part of the story of expanding the health sector. Expanding the health sector output also implies more services and treatments for the sick and unable to work labour. If these are cured and return to work, it may increase labour participation rates and labour productivity i.e. the scale effect of increasing health sector output. The net impact on the economy will therefore depend on which outcome dominates. In developing countries, with a high disease burden, the scale-effect tends to dominate because the marginal return of health output (treatments) is often high. The case varies for developed countries. See Chapter 2 in Kabajulizi (2016) for a detailed discussion of the theoretical outcomes of the model.

Table 3 Real sector GDP annual growth rate 2020-2030: deviation from baseline (%-point)

	Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Agriculture	3.5	0.10	-0.03	-0.05	-0.06	-0.03	-0.01
Forestry	7.6	0.14	-0.11	-0.12	-0.23	-0.18	-0.09
Fishing	5.2	0.16	-0.07	-0.08	-0.19	-0.04	0.00
Other mining	8.1	0.22	-0.10	-0.17	-0.08	-0.27	-0.16
Meat, fish, and dairy	1.9	0.11	0.02	-0.04	0.06	0.02	0.01
Fruit and vegetable processing	4.6	0.10	-0.05	-0.08	-0.13	-0.03	0.00
Fats and oils	4.0	0.11	-0.03	-0.08	-0.07	-0.01	0.01
Grain milling	4.1	0.10	-0.05	-0.06	-0.11	-0.05	-0.02
Sugar refining	3.2	0.26	0.02	-0.12	0.02	0.00	-0.02
Other foods	5.2	0.11	-0.07	-0.07	-0.20	-0.04	0.00
Beverages	6.3	0.24	-0.06	-0.13	-0.20	-0.05	-0.01
Other manufacturing	7.8	0.31	-0.08	-0.21	0.03	-0.17	-0.11
Chemicals	7.2	0.12	-0.07	-0.17	-0.18	-0.05	-0.02
Machinery and equipment	41.2	0.11	-0.64	-0.01	1.02	-0.64	-0.40
Utilities	6.9	0.12	-0.11	-0.11	-0.20	-0.10	-0.04
Construction	7.2	0.13	-0.11	-0.13	-0.16	-0.30	-0.18
Wholesale and retail trade	0.3	0.01	-0.01	-0.01	-0.01	-0.01	0.00
Transport and storage	5.6	0.20	-0.04	-0.18	-0.12	-0.02	-0.01
Other private services	5.8	0.10	-0.05	-0.16	-0.09	-0.07	-0.04
Public administration	3.2	0.01	0.02	-0.04	0.04	0.46	0.45
Education	6.0	0.11	-0.06	-0.13	-0.21	-0.02	0.02
Health and social work	5.8	0.06	-0.07	-0.10	-0.22	0.54	0.58
Other services	6.6	0.08	-0.10	-0.11	-0.24	-0.10	-0.04
Total	5.9	0.11	-0.10	-0.10	-0.03	-0.09	-0.04

Source: CGE modelling results

Table 4 Annual growth rate in economy-wide wage (rent) for factors 2020 -2030: deviation from baseline (%-points)

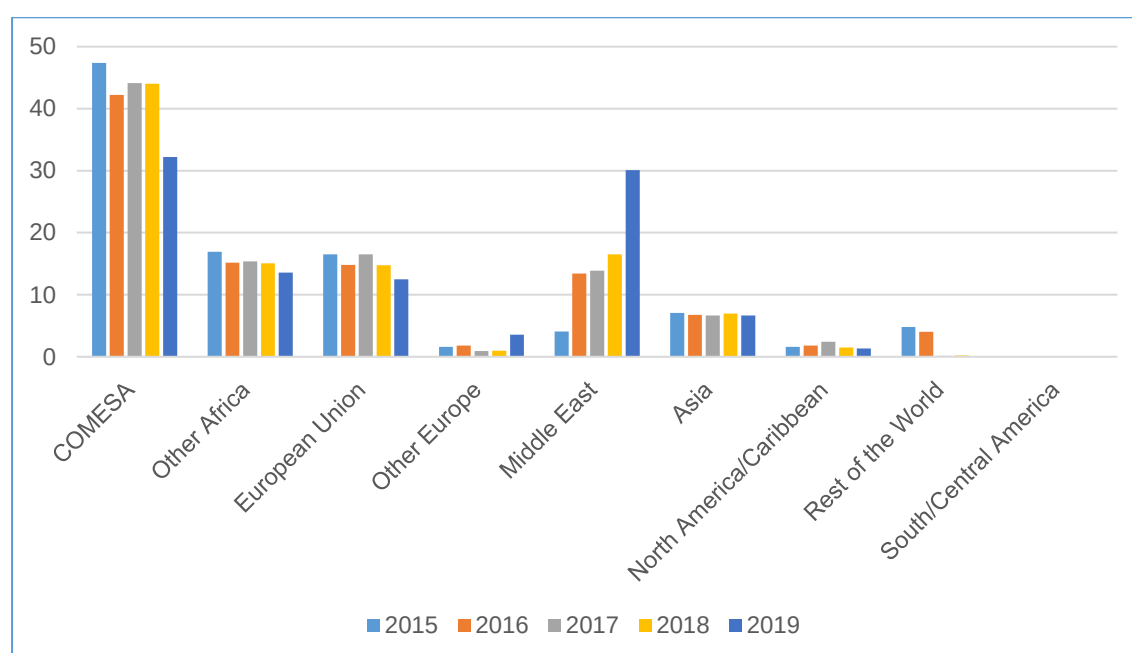
	Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - rural uneducated	1.9	-1.10	-0.12	-0.05	-0.12	-0.15	-0.08
Labour - rural primary	2.0	-1.10	-0.12	-0.05	-0.08	-0.16	-0.08
Labour - rural secondary	2.0	-1.11	-0.13	-0.03	-0.11	-0.10	-0.01
Labour - rural tertiary	1.2	0.14	-0.10	-0.02	-0.24	0.04	0.11
Labour - urban uneducated	2.9	0.16	-0.10	-0.05	0.03	-0.17	-0.08
Labour - urban primary	1.3	0.15	-0.04	-0.06	-0.10	-0.13	-0.06
Labour - urban secondary	1.4	0.15	-0.05	-0.04	-0.11	-0.04	0.03
Labour - urban tertiary	0.2	0.12	-0.08	0.00	-0.16	0.16	0.21
Land - agricultural crops	8.1	0.18	-0.11	-0.16	-0.28	-0.11	-0.04
Capital - crops	0.3	0.06	0.03	-0.05	-0.07	0.04	0.00
Capital - livestock	0.3	0.06	0.03	-0.05	-0.07	0.04	0.00
Capital - mining	1.4	0.05	0.09	-0.02	0.02	0.07	-0.03
Capital - other	0.7	0.08	0.04	-0.06	0.08	0.02	-0.01

Source: CGE modelling results

4.2 International trade

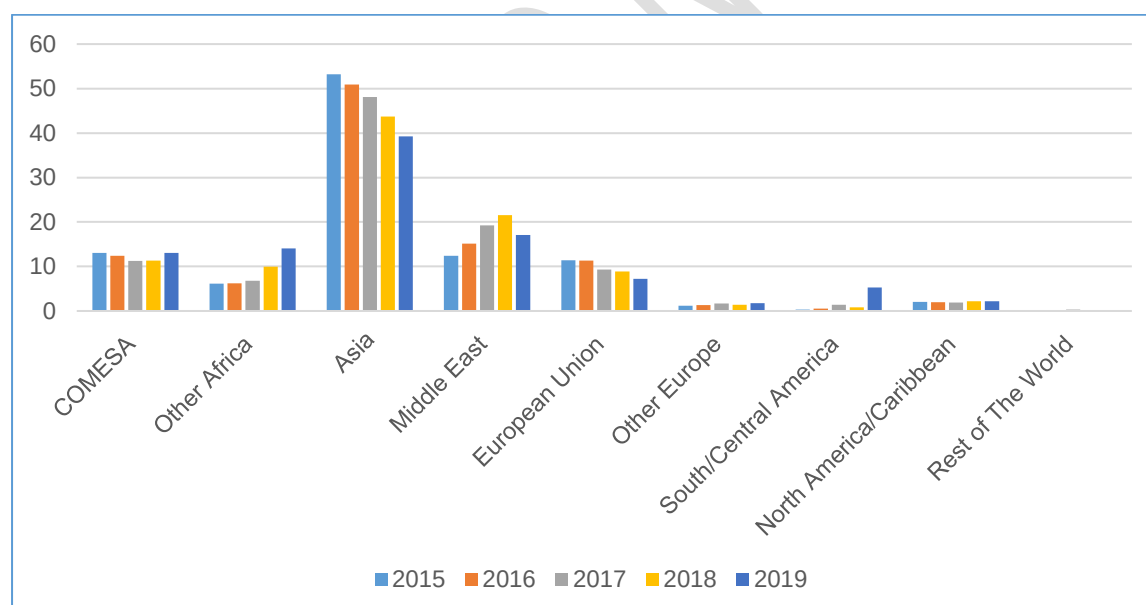
The results for exports and imports performance are a reflection the pattern of trade in Uganda. Coffee has been Uganda's leading export commodity accounting for over 15% share of total export value. However, non-traditional exports have been growing, including gold and gold compounds whose exports has drastically grown since 2015 and reached 35% share in 2019. The major imports comprise of non-monetary gold, petroleum products, motor vehicles, iron and steel products, medical products and pharmaceuticals, plastics in primary forms, machinery for industries, and vegetable fats and oils. Uganda operates a trade deficit. As shown in Figure 2a and Figure 2b, the African region is the main destination of Uganda's exports with the top five being Kenya, Democratic Republic of Congo, South Sudan, Rwanda and Tanzania chronologically. Similarly, imports mainly originate from Asia, topped by China and India.

Figure 2a: Exports by region and of destination by percentage 2015–2019



Data source: Uganda Bureau of Statistics, Statistical Abstract 2020

Figure 2b: Imports by percentage share and region of origin, 2015-2019



Data source: Uganda Bureau of Statistics, Statistical Abstract 2020

The impact of Covid-19 on imports and exports is shown in Table 5 which presents results for the annual growth rates in selected macro variables compared to the baseline. The predicted decline in growth rates is attributed to disruptions in trade flows brought about by border closures with trading partners which slowed down the value chain. Although country borders

have since opened with strict observance of Covid-19 standing operating procedures, it will take some countries quite a few years to recover to the pre-Covid-19 operating capacity. The predicted higher growth rates in exports under the scenario that increases non-tertiary rural labour could be explained by the composition of Uganda's exports and trading partners. Uganda exports a significant amount of agricultural products to the neighbouring countries of Kenya, Rwanda, Democratic Republic of Congo, South Sudan, and Tanzania, through informal trade routes at border posts and bus terminals while imports of manufactures mainly come from Kenya through the same routes. Informal trade flows data is collected through Informal Cross Border Trade surveys and included in the national accounts as informal imports and exports⁸ (Uganda Bureau of Statistics, 2020). The informal trade routes continue to operate even when the border cargo clearing offices are closed or restricted by Covid-19 regulations.

Table 5 Annual growth rate in share of selected real macro variables in GDP: deviation from the baseline (%-age points)

	Baseline	Non-tertiary rural labour increases	Non-tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Absorption	-0.02	-0.01	0.01	0.01	-0.17	0.01	0.02
Private consumption	-0.28	-0.01	0.01	0.02	-0.21	0.02	0.01
Investment	1.31	0.01	-0.01	-0.03	-0.12	-0.21	-0.14
Government consumption	-2.76	-0.10	0.09	0.09	0.03	0.96	0.91
Exports	3.35	0.03	-0.10	-0.02	0.40	-0.14	-0.12
Imports	2.24	-0.01	-0.05	0.01	-0.21	-0.08	-0.03
Net Indirect taxes	0.07	0.01	0.01	0.00	-0.05	-0.05	-0.04

Source: CGE modelling results

4.3 Household welfare

The impact of Covid-19 restrictions on household welfare is mainly negative across households although the magnitude varies by scenario, as shown by changes in consumption expenditure in Table 6 and equivalent variation in Table 7. The equivalent variation is a consumption-based measure of welfare that controls for changes in prices. The growth in consumption expenditure under the non-tertiary labour increase scenario suggests a degree of resilience amidst the Covid-19 shocks. This is possible because the majority of households earn more than half of

⁸These informal trade transactions do not go through official clearance and documentation processes required by the customs laws.

their income from the ownership of land for agricultural crops, and capital for crops and livestock (see Appendix Table A1 and Table A2) for which activities carried out are mainly rural based and continue to operate even during Covid-19 restrictions. Additionally, the agricultural sector which employs more than 67% of Uganda's total labour force, acts as a cushion to the external shocks since individuals are able to engage in agricultural activities during the lockdown restrictions.

Among the scenarios, the decline in remittances tends to cause the largest reduction in welfare among all households. This is plausible because remittance recipients often use the income to smooth out household consumption expenditure gaps (Ajaero et al., 2018) and act as insurance for households, tending to increase when the recipient income falls (Yang and Choi, 2007). Therefore, a reduction in remittance inflows means the households are in a precarious position, recipient households' welfare declines as observed in our results.

Table 6 Annual growth rate in household consumption expenditure 2020 – 2030: deviation from baseline (%-points)

	Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Rural farm - Q1	6.9	0.10	-0.10	-0.24	-0.24	-0.11	-0.05
Rural farm - Q2	6.9	0.10	-0.10	-0.26	-0.26	-0.11	-0.05
Rural farm - Q3	6.8	0.10	-0.09	-0.27	-0.27	-0.10	-0.05
Rural farm - Q4	6.7	0.09	-0.10	-0.26	-0.26	-0.10	-0.05
Rural farm - Q5	6.7	0.10	-0.09	-0.34	-0.34	-0.10	-0.05
Rural nonfarm -Q1	6.3	0.05	-0.10	-0.19	-0.19	-0.12	-0.07
Rural nonfarm -Q2	6.3	0.06	-0.10	-0.18	-0.18	-0.12	-0.07
Rural nonfarm -Q3	6.2	0.06	-0.10	-0.16	-0.16	-0.12	-0.06
Rural nonfarm -Q4	6.3	0.07	-0.10	-0.18	-0.18	-0.12	-0.06
Rural nonfarm -Q5	6.3	0.08	-0.10	-0.30	-0.30	-0.10	-0.05
Urban - Q1	6.6	0.15	-0.09	-0.26	-0.26	-0.11	-0.05
Urban - Q2	6.5	0.15	-0.09	-0.26	-0.26	-0.11	-0.05
Urban - Q3	6.4	0.14	-0.09	-0.27	-0.27	-0.10	-0.04
Urban - Q4	6.2	0.14	-0.09	-0.29	-0.29	-0.09	-0.04
Urban - Q5	5.9	0.13	-0.09	-0.31	-0.31	-0.05	0.00

Source: CGE modelling results

Table 7 Disaggregated EV by household 2020 - 2030: deviation from baseline (%-age points)

	Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Rural farm - Q1	7.4	0.15	-0.13	-0.15	-0.29	-0.14	-0.06
Rural farm - Q2	7.4	0.15	-0.13	-0.15	-0.33	-0.14	-0.06
Rural farm - Q3	7.4	0.14	-0.13	-0.15	-0.36	-0.14	-0.06
Rural farm - Q4	7.5	0.13	-0.13	-0.15	-0.35	-0.14	-0.06
Rural farm - Q5	8.2	0.15	-0.15	-0.17	-0.55	-0.16	-0.07
Rural nonfarm -Q1	6.3	0.07	-0.13	-0.10	-0.20	-0.16	-0.09
Rural nonfarm -Q2	6.4	0.08	-0.13	-0.11	-0.19	-0.16	-0.09
Rural nonfarm -Q3	6.5	0.08	-0.13	-0.11	-0.16	-0.16	-0.08
Rural nonfarm -Q4	7.0	0.11	-0.14	-0.13	-0.23	-0.17	-0.08
Rural nonfarm -Q5	7.7	0.12	-0.15	-0.14	-0.48	-0.16	-0.07
Urban - Q1	7.1	0.24	-0.13	-0.14	-0.34	-0.15	-0.07
Urban - Q2	6.9	0.23	-0.12	-0.13	-0.33	-0.14	-0.06
Urban - Q3	6.9	0.22	-0.12	-0.12	-0.36	-0.13	-0.05
Urban - Q4	7.2	0.22	-0.13	-0.13	-0.41	-0.13	-0.05
Urban - Q5	7.4	0.22	-0.14	-0.13	-0.50	-0.08	0.01

Source: CGE modelling results

5. Conclusions

This study set out to evaluate the impact of Covid-19 on the Uganda economy. We designed scenarios to mimic the performance of the economy under the Covid-19 pandemic mitigation strategies, focussing on impact channels via labour supply, labour productivity, government health spending and remittance inflows and employed a recursive dynamic model to predict the impact on sector performance, international trade and welfare. We find that growth rates in sectors output decline for many of the sectors under all scenarios except for the increase in non-tertiary rural labour scenario. Also, the increased government health spending induces expansion in the healthcare output but the sectors that produce the intermediate inputs for healthcare production do not grow in tandem. This suggests the healthcare inputs are largely imported. There is an increase export growth rates when we assume an increase in supply of non-tertiary rural labour, suggesting that agricultural products exported to neighbouring countries through informal channels persist even during the Covid-19 restrictions. The results on welfare effects show that a reduction in remittance inflows is predicted to generate the most decline in welfare.

These results have the following policy implications. On sector performance, they call for policymakers to revisit Uganda's industrial policy and reorient it towards domestic production of commodities that are intermediate inputs to critical domestic sectors such as healthcare. Additionally, there is a need to accelerate rural infrastructure development particularly the road network, to facilitate an integrated rural economy induced by the shift in labour and enterprise towards rural areas. On welfare, government should consider transfers to households to mitigate the adverse effects of Covid-19 particularly for remittance recipient households.

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Appendix

Table A1: Household shares per factor (%): distribution of household categories for each type of factor

Household category / factor type	Labour - rural uneducated	Labour - rural primary	Labour - rural secondary	Labour - rural tertiary	Labour - urban uneducated	Labour - urban primary	Labour - urban secondary	Labour - urban tertiary	Land - agricultural crops	Capital - crops	Capital - livestock
Rural farm - Q1	9.9	6.1	2.8	0.8	0.0	0.0	0.0	0.0	10.7	10.8	3.8
Rural farm - Q2	12.6	9.2	6.9	0.5	0.0	0.0	0.0	0.0	16.8	16.8	8.4
Rural farm - Q3	13.5	12.0	11.8	1.1	0.0	0.0	0.0	0.0	19.5	19.4	15.6
Rural farm - Q4	16.6	14.0	20.1	4.1	0.0	0.0	0.0	0.0	21.9	21.9	21.9
Rural farm - Q5	6.3	9.7	12.2	8.2	0.0	0.0	0.0	0.0	13.6	13.5	17.6
Rural nonfarm -Q1	8.8	5.3	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rural nonfarm -Q2	7.0	7.1	2.7	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rural nonfarm -Q3	8.2	10.0	6.5	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rural nonfarm -Q4	9.9	11.5	10.6	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rural nonfarm -Q5	7.2	15.1	24.8	60.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Urban - Q1	0.0	0.0	0.0	0.0	8.4	3.6	0.4	0.0	1.3	1.3	0.4
Urban - Q2	0.0	0.0	0.0	0.0	8.2	5.2	1.5	0.1	1.8	1.8	0.8
Urban - Q3	0.0	0.0	0.0	0.0	14.8	10.0	3.3	1.0	2.8	2.8	2.1
Urban - Q4	0.0	0.0	0.0	0.0	28.7	24.6	18.2	4.2	5.2	5.2	9.5
Urban - Q5	0.0	0.0	0.0	0.0	39.9	56.7	76.7	94.6	6.6	6.6	19.9
Total	100	100	100	100	100	100	100	100	100	100	100

Source: Author computation from the Uganda SAM2013

Table A2 Factor shares per household type (%): distribution of factor types in each household categories

Household category / factor type	Labour - rural uneducated	Labour - rural primary	Labour - rural secondary	Labour - rural tertiary	Labour - urban uneducated	Labour - urban primary	Labour - urban secondary	Labour - urban tertiary	Land - agricultural crops	Capital - crops	Capital - livestock	Total
Rural farm - Q1	3.8	12.4	4.0	0.6	0.0	0.0	0.0	0.0	52.5	17.7	9.0	100
Rural farm - Q2	2.9	11.6	6.0	0.2	0.0	0.0	0.0	0.0	50.3	16.9	12.0	100
Rural farm - Q3	2.4	11.6	8.0	0.4	0.0	0.0	0.0	0.0	45.2	15.1	17.3	100
Rural farm - Q4	2.4	11.0	11.0	1.2	0.0	0.0	0.0	0.0	41.1	13.8	19.6	100
Rural farm - Q5	1.4	11.3	9.9	3.5	0.0	0.0	0.0	0.0	37.9	12.6	23.4	100
Rural nonfarm -Q1	20.0	64.8	13.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Rural nonfarm -Q2	11.7	64.7	17.4	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Rural nonfarm -Q3	8.0	52.7	24.1	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Rural nonfarm -Q4	7.1	44.5	28.6	19.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Rural nonfarm -Q5	2.4	27.2	31.0	39.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Urban - Q1	0.0	0.0	0.0	0.0	8.0	28.0	5.3	0.0	39.6	13.5	5.7	100
Urban - Q2	0.0	0.0	0.0	0.0	5.0	25.5	13.2	1.5	35.3	11.8	7.6	100
Urban - Q3	0.0	0.0	0.0	0.0	4.6	25.1	14.9	7.7	28.3	9.5	9.9	100
Urban - Q4	0.0	0.0	0.0	0.0	3.0	20.7	27.5	10.4	17.4	5.8	15.2	100
Urban - Q5	0.0	0.0	0.0	0.0	0.9	10.4	25.1	50.3	4.8	1.6	6.9	100

Source: Author computation from the Uganda SAM2013

Table A3 Household expenditure shares by commodity

	Rural farm - Q1	Rural farm - Q2	Rural farm - Q3	Rural farm - Q4	Rural farm - Q5	Rural nonfarm -Q1	Rural nonfarm -Q2	Rural nonfarm -Q3	Rural nonfarm -Q4	Rural nonfarm -Q5	Urban - Q1	Urban - Q2	Urban - Q3	Urban - Q4	Urban - Q5
Agriculture	14.1	12.7	11.5	11.0	7.8	17.9	16.1	14.6	13.5	9.8	16.3	15.3	15.6	14.0	10.4
Forestry	2.3	2.6	2.7	2.0	1.5	2.1	3.9	4.0	3.8	2.4	3.5	4.4	7.4	6.2	3.5
Fishing	1.6	1.7	2.0	1.3	1.2	1.3	1.5	1.5	2.4	1.1	1.4	0.6	1.4	1.4	0.8
Meat, fish and dairy	10.2	9.1	7.8	6.1	3.3	8.2	8.9	8.8	7.3	5.1	6.5	11.1	8.4	6.3	3.6
Fruit and veg processing	2.8	2.5	1.8	1.8	0.9	1.8	1.8	2.0	1.5	0.9	2.8	2.1	2.1	1.6	0.8
Fats and oils	3.4	3.1	2.2	2.2	1.1	2.2	2.2	2.5	1.9	1.1	3.5	2.6	2.6	2.0	1.0
Grain milling	11.6	7.4	6.4	6.5	3.3	13.5	10.5	8.2	4.7	2.4	7.5	8.5	8.9	5.8	1.7
Sugar refining	3.2	4.6	3.8	3.0	1.7	3.1	4.0	4.1	3.3	1.8	3.2	3.7	4.4	3.1	1.6
Other foods	1.1	1.1	1.4	1.3	1.3	1.3	2.2	2.1	2.7	3.0	2.3	1.7	1.6	3.2	4.7
Beverages	3.4	4.7	4.5	4.4	6.0	8.6	4.5	3.8	4.4	4.8	3.8	2.9	2.3	2.9	3.8
Other manufacturing	12.5	12.3	11.6	12.8	11.0	11.0	11.1	10.0	9.3	11.1	10.3	10.4	8.5	8.3	10.1
Chemicals	12.8	12.2	10.9	9.2	6.8	10.8	10.1	9.8	8.1	7.7	12.3	8.3	7.7	6.0	6.4
Machinery and equipment	0.5	0.5	0.9	1.8	2.9	0.3	0.7	0.9	1.2	3.4	0.7	0.6	0.6	0.9	3.4
Utilities	1.8	0.7	1.3	1.0	0.8	1.5	1.0	1.9	3.7	3.0	3.2	4.1	5.4	5.9	6.0
Wholesale and retail trade	0.1	0.1	0.2	0.5	1.9	0.1	0.2	0.1	0.5	0.6	0.0	0.1	0.2	0.1	0.5
Transport and storage	2.6	3.8	4.6	5.2	5.0	2.1	4.2	5.3	5.4	5.9	3.2	3.8	4.0	4.8	6.4
Other private services	2.8	5.0	6.9	6.8	12.5	2.7	4.0	4.7	7.8	14.9	4.1	4.6	6.4	8.5	16.7
Education	7.9	8.5	10.1	10.9	8.1	5.1	6.8	7.5	9.0	9.1	8.8	9.7	6.8	12.0	10.1
Health and social work	5.0	6.2	7.4	8.2	7.5	6.4	6.0	7.1	7.2	7.3	6.6	5.6	5.2	5.6	5.6
Other services	0.3	1.2	2.0	3.9	15.6	0.0	0.4	0.9	2.4	4.5	0.0	0.0	0.7	1.6	2.9
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Author computation from the Uganda SAM2013

Table A4 Annual growth rate in quantity demanded of labour by sector 2019 -2030: deviation from baseline (%-point)

	Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - rural uneducated							
Agriculture	3.9	0.91	0.01	0.00	-0.10	0.04	0.03
Forestry	5.3	0.94	-0.01	-0.03	-0.09	-0.07	-0.04
Fishing	3.0	0.88	0.02	0.02	-0.06	0.06	0.04
Other mining	6.3	0.83	0.00	-0.02	0.00	-0.15	-0.13
Meat, fish and dairy	-0.3	0.80	0.09	0.08	0.16	0.11	0.06
Fruit and vegetable processing	2.3	0.81	0.03	0.05	-0.03	0.06	0.05
Fats and oils	1.7	0.81	0.05	0.05	0.03	0.08	0.06
Grain milling	1.9	0.80	0.03	0.07	-0.01	0.05	0.03
Sugar refining	0.9	0.86	0.07	0.05	0.08	0.07	0.03
Other foods	2.9	0.89	0.03	0.03	-0.07	0.06	0.05
Beverages	4.1	0.89	0.02	0.00	-0.09	0.04	0.03
Other manufacturing	5.5	1.09	0.02	-0.10	0.16	-0.06	-0.06
Chemicals	4.9	0.92	0.03	-0.06	-0.06	0.05	0.03
Machinery and equipment	38.3	1.18	-0.49	0.10	1.18	-0.48	-0.33
Construction	4.9	0.91	-0.01	-0.01	-0.04	-0.19	-0.12
Wholesale and retail trade	-1.8	0.77	0.09	0.07	0.11	0.10	0.04
Transport and storage	3.3	0.92	0.03	-0.03	-0.03	0.07	0.05
Other private services	3.4	0.90	0.03	-0.03	0.01	0.05	0.03
Public administration	0.4	0.77	0.05	0.19	0.03	0.61	0.58
Education	3.6	0.88	0.00	0.04	-0.15	0.11	0.11
Other services	4.3	0.91	-0.01	0.01	-0.12	0.01	0.02

		Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - rural primary	Agriculture	3.8	0.91	0.02	0.00	-0.13	0.04	0.03
	Forestry	5.3	0.94	0.00	-0.03	-0.12	-0.06	-0.04
	Fishing	2.9	0.88	0.03	0.02	-0.10	0.06	0.04
	Other mining	6.2	0.82	0.00	-0.02	-0.04	-0.14	-0.13
	Meat, fish and dairy	-0.4	0.80	0.10	0.08	0.13	0.11	0.06
	Fruit and vegetable processing	2.3	0.81	0.03	0.05	-0.06	0.07	0.05
	Fats and oils	1.7	0.81	0.05	0.05	-0.01	0.09	0.06
	Grain milling	1.8	0.80	0.04	0.07	-0.04	0.05	0.03
	Sugar refining	0.9	0.85	0.08	0.05	0.05	0.08	0.03
	Other foods	2.9	0.89	0.03	0.03	-0.11	0.07	0.05
	Beverages	4.0	0.89	0.02	0.00	-0.12	0.04	0.03
	Other manufacturing	5.5	1.09	0.03	-0.10	0.12	-0.06	-0.06
	Chemicals	4.8	0.92	0.03	-0.06	-0.10	0.05	0.03
	Machinery and equipment	38.2	1.18	-0.49	0.10	1.14	-0.48	-0.33
	Construction	4.8	0.91	-0.01	-0.01	-0.07	-0.19	-0.12
	Wholesale and retail trade	-1.9	0.77	0.09	0.07	0.08	0.10	0.04
	Transport and storage	3.2	0.92	0.03	-0.03	-0.06	0.07	0.04
	Other private services	3.3	0.90	0.04	-0.03	-0.02	0.05	0.03
	Public administration	0.3	0.77	0.05	0.19	0.00	0.61	0.58
	Education	3.5	0.88	0.01	0.04	-0.18	0.11	0.11
	Health and social work	3.3	0.88	0.01	0.05	-0.17	0.66	0.65
	Other services	4.2	0.91	0.00	0.01	-0.16	0.02	0.02

		Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - rural secondary	Agriculture	3.8	0.92	0.02	-0.01	-0.11	-0.01	-0.02
	Forestry	5.3	0.95	0.00	-0.05	-0.09	-0.11	-0.09
	Fishing	2.9	0.89	0.03	0.00	-0.07	0.02	-0.01
	Other mining	6.2	0.84	0.01	-0.04	-0.01	-0.19	-0.18
	Meat, fish and dairy	-0.4	0.81	0.10	0.07	0.15	0.07	0.01
	Fruit and vegetable processing	2.3	0.82	0.04	0.04	-0.03	0.02	0.00
	Fats and oils	1.7	0.82	0.05	0.03	0.02	0.04	0.01
	Grain milling	1.8	0.81	0.04	0.06	-0.02	0.01	-0.02
	Sugar refining	0.9	0.86	0.08	0.04	0.07	0.03	-0.01
	Other foods	2.9	0.90	0.04	0.01	-0.08	0.02	0.00
	Beverages	4.0	0.90	0.03	-0.02	-0.09	0.00	-0.02
	Other manufacturing	5.5	1.10	0.03	-0.12	0.15	-0.10	-0.11
	Chemicals	4.8	0.93	0.04	-0.07	-0.07	0.01	-0.02
	Machinery and equipment	38.2	1.19	-0.48	0.08	1.17	-0.54	-0.40
	Utilities	4.4	0.93	-0.01	0.00	-0.10	-0.02	-0.02
	Construction	4.9	0.92	-0.01	-0.03	-0.05	-0.23	-0.17
	Wholesale and retail trade	-1.8	0.78	0.10	0.06	0.11	0.06	0.00
	Transport and storage	3.3	0.93	0.04	-0.04	-0.04	0.03	0.00
	Other private services	3.4	0.91	0.04	-0.04	0.00	0.01	-0.02
	Public administration	0.3	0.78	0.05	0.18	0.03	0.57	0.54
	Education	3.5	0.89	0.01	0.02	-0.16	0.07	0.06
	Health and social work	3.3	0.89	0.01	0.03	-0.14	0.62	0.60
	Other services	4.2	0.92	0.00	-0.01	-0.13	-0.03	-0.03

	Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - rural							
tertiary							
Agriculture	4.4	0.02	0.00	-0.02	-0.01	-0.11	-0.11
Fishing	3.4	0.00	0.02	0.00	0.02	-0.08	-0.10
Other mining		0.00	0.00	0.00	0.00	0.00	0.00
Meat, fish and dairy	0.1	-0.05	0.08	0.06	0.24	-0.03	-0.07
Fruit and vegetable processing	2.8	-0.07	0.02	0.03	0.06	-0.08	-0.09
Fats and oils	2.2	-0.06	0.04	0.03	0.11	-0.05	-0.08
Grain milling	2.3	-0.07	0.02	0.05	0.07	-0.09	-0.11
Sugar refining	1.4	-0.01	0.07	0.03	0.16	-0.06	-0.10
Other foods	3.4	0.01	0.02	0.01	0.01	-0.08	-0.09
Other manufacturing	6.0	0.19	0.01	-0.13	0.25	-0.21	-0.20
Chemicals	5.4	0.02	0.02	-0.08	0.02	-0.09	-0.11
Machinery and equipment	38.9	-0.01	-0.51	0.07	1.30	-0.67	-0.52
Utilities	5.0	0.03	-0.03	-0.01	-0.01	-0.12	-0.11
Construction	5.4	0.01	-0.02	-0.03	0.05	-0.33	-0.26
Wholesale and retail trade	-1.3	-0.07	0.08	0.05	0.20	-0.03	-0.09
Transport and storage	3.8	0.04	0.02	-0.05	0.06	-0.07	-0.09
Other private services	3.9	0.02	0.02	-0.05	0.10	-0.09	-0.11
Public administration	0.9	-0.09	0.04	0.17	0.12	0.47	0.45
Education	4.1	-0.01	-0.01	0.02	-0.07	-0.03	-0.03
Health and social work	3.8	0.00	0.00	0.02	-0.05	0.52	0.52
Other services	4.8	0.02	-0.02	-0.01	-0.04	-0.13	-0.12

		Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - urban uneducated	Agriculture	3.2	0.01	0.00	0.00	-0.20	0.04	0.03
	Forestry	4.6	0.03	-0.02	-0.03	-0.19	-0.06	-0.04
	Fishing	2.2	-0.02	0.01	0.02	-0.17	0.07	0.04
	Other mining	5.5	-0.10	-0.01	-0.02	-0.11	-0.14	-0.13
	Meat, fish and dairy	-1.0	-0.06	0.08	0.08	0.05	0.12	0.06
	Fruit and vegetable processing	1.6	-0.08	0.02	0.05	-0.13	0.07	0.05
	Fats and oils	1.0	-0.07	0.03	0.04	-0.08	0.09	0.06
	Grain milling	1.1	-0.08	0.02	0.07	-0.11	0.05	0.03
	Sugar refining	0.2	-0.02	0.06	0.05	-0.02	0.08	0.03
	Other foods	2.2	0.00	0.02	0.03	-0.18	0.07	0.05
	Beverages	3.3	-0.01	0.01	-0.01	-0.19	0.05	0.03
	Other manufacturing	4.8	0.17	0.01	-0.10	0.05	-0.05	-0.06
	Chemicals	4.1	0.01	0.02	-0.06	-0.17	0.06	0.03
	Machinery and equipment	37.3	-0.03	-0.50	0.10	1.03	-0.47	-0.33
	Utilities	3.7	0.01	-0.03	0.01	-0.20	0.03	0.03
	Construction	4.2	0.00	-0.03	-0.01	-0.15	-0.18	-0.12
	Wholesale and retail trade	-2.5	-0.08	0.08	0.07	0.01	0.11	0.04
	Transport and storage	2.6	0.02	0.02	-0.03	-0.13	0.08	0.04
	Other private services	2.7	0.00	0.02	-0.03	-0.10	0.06	0.03
	Education	2.9	-0.02	-0.01	0.04	-0.26	0.12	0.10
	Health and social work	2.6	-0.02	-0.01	0.04	-0.24	0.66	0.65
	Other services	3.5	0.00	-0.02	0.01	-0.23	0.02	0.02

		Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - urban primary	Agriculture	4.3	0.01	-0.04	0.01	-0.12	0.02	0.01
	Forestry	5.8	0.03	-0.06	-0.03	-0.10	-0.08	-0.06
	Fishing	3.4	-0.01	-0.03	0.02	-0.08	0.04	0.02
	Other mining	6.7	-0.10	-0.05	-0.02	-0.02	-0.17	-0.14
	Meat, fish and dairy	0.1	-0.06	0.04	0.09	0.14	0.09	0.04
	Fruit and vegetable processing	2.8	-0.08	-0.02	0.06	-0.04	0.05	0.03
	Fats and oils	2.2	-0.07	-0.01	0.05	0.01	0.07	0.04
	Grain milling	2.3	-0.08	-0.02	0.08	-0.03	0.03	0.01
	Sugar refining	1.4	-0.02	0.02	0.06	0.06	0.06	0.02
	Other foods	3.4	0.00	-0.02	0.03	-0.09	0.05	0.03
	Beverages	4.5	-0.01	-0.03	0.00	-0.11	0.03	0.01
	Other manufacturing	6.0	0.18	-0.03	-0.10	0.14	-0.08	-0.08
	Chemicals	5.3	0.01	-0.02	-0.05	-0.08	0.03	0.01
	Machinery and equipment	38.8	-0.02	-0.56	0.11	1.17	-0.51	-0.36
	Utilities	4.9	0.02	-0.07	0.02	-0.11	0.01	0.01
	Construction	5.3	0.00	-0.07	-0.01	-0.06	-0.21	-0.14
	Wholesale and retail trade	-1.4	-0.08	0.04	0.08	0.10	0.08	0.03
	Transport and storage	3.7	0.03	-0.02	-0.02	-0.05	0.05	0.03
	Other private services	3.9	0.01	-0.02	-0.02	-0.01	0.03	0.01
	Public administration	0.8	-0.10	0.00	0.20	0.02	0.59	0.57
	Education	4.0	-0.02	-0.05	0.04	-0.17	0.09	0.09
	Health and social work	3.8	-0.01	-0.05	0.05	-0.16	0.65	0.64
	Other services	4.7	0.01	-0.06	0.01	-0.14	0.00	0.00

		Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - urban secondary	Agriculture	4.3	0.01	-0.03	-0.01	-0.11	-0.04	-0.05
	Forestry	5.7	0.03	-0.05	-0.04	-0.10	-0.15	-0.12
	Fishing	3.3	-0.01	-0.02	0.01	-0.07	-0.02	-0.04
	Other mining	6.6	-0.09	-0.05	-0.03	-0.01	-0.23	-0.21
	Meat, fish and dairy	0.0	-0.06	0.05	0.07	0.15	0.03	-0.02
	Fruit and vegetable processing	2.7	-0.08	-0.02	0.04	-0.04	-0.01	-0.03
	Fats and oils	2.1	-0.07	0.00	0.04	0.02	0.01	-0.02
	Grain milling	2.2	-0.08	-0.01	0.06	-0.02	-0.03	-0.05
	Sugar refining	1.3	-0.02	0.03	0.04	0.07	0.00	-0.04
	Other foods	3.3	0.00	-0.01	0.02	-0.08	-0.01	-0.03
	Beverages	4.4	-0.01	-0.03	-0.01	-0.10	-0.04	-0.05
	Other manufacturing	5.9	0.18	-0.02	-0.11	0.15	-0.14	-0.14
	Chemicals	5.3	0.01	-0.02	-0.07	-0.07	-0.03	-0.05
	Machinery and equipment	38.8	-0.02	-0.55	0.09	1.18	-0.59	-0.44
	Utilities	4.9	0.02	-0.06	0.01	-0.10	-0.05	-0.05
	Construction	5.3	0.00	-0.06	-0.02	-0.05	-0.27	-0.20
	Wholesale and retail trade	-1.4	-0.08	0.05	0.07	0.11	0.03	-0.03
	Transport and storage	3.7	0.03	-0.01	-0.04	-0.04	-0.01	-0.03
	Other private services	3.8	0.01	-0.01	-0.04	0.00	-0.03	-0.05
	Public administration	0.8	-0.10	0.00	0.18	0.03	0.54	0.51
	Education	4.0	-0.02	-0.04	0.03	-0.16	0.03	0.03
	Health and social work	3.7	-0.01	-0.04	0.04	-0.15	0.58	0.58
	Other services	4.7	0.01	-0.05	0.00	-0.13	-0.06	-0.06

		Baseline	Non- tertiary rural labour increases	Non- tertiary urban labour declines	Decline in labour productivity: all sectors	Reduced remittance inflows	Increase in gov health spending (fixed budget)	Foreign aid for gov health spending
Labour - urban tertiary	Agriculture	5.1	0.03	-0.01	-0.04	-0.07	-0.19	-0.19
	Forestry	6.5	0.05	-0.03	-0.07	-0.06	-0.30	-0.26
	Meat, fish and dairy	0.8	-0.04	0.07	0.04	0.19	-0.11	-0.15
	Fruit and vegetable processing	3.5	-0.06	0.01	0.01	0.00	-0.16	-0.16
	Fats and oils	2.9	-0.05	0.02	0.01	0.06	-0.14	-0.15
	Grain milling	3.0	-0.06	0.01	0.03	0.02	-0.18	-0.18
	Sugar refining	2.1	0.00	0.05	0.01	0.11	-0.15	-0.18
	Other foods	4.1	0.02	0.01	-0.01	-0.04	-0.16	-0.17
	Beverages	5.2	0.01	0.00	-0.04	-0.06	-0.18	-0.19
	Other manufacturing	6.8	0.20	0.00	-0.15	0.19	-0.29	-0.28
	Chemicals	6.1	0.04	0.01	-0.10	-0.03	-0.18	-0.19
	Machinery and equipment	39.9	0.01	-0.53	0.05	1.24	-0.79	-0.62
	Utilities	5.7	0.04	-0.04	-0.02	-0.06	-0.20	-0.19
	Construction	6.1	0.02	-0.04	-0.05	-0.01	-0.42	-0.34
	Wholesale and retail trade	-0.7	-0.06	0.07	0.04	0.15	-0.11	-0.16
	Transport and storage	4.5	0.05	0.01	-0.07	0.00	-0.16	-0.17
	Other private services	4.6	0.03	0.01	-0.07	0.04	-0.18	-0.18
	Public administration	1.5	-0.08	0.02	0.16	0.07	0.39	0.38
	Education	4.8	0.00	-0.02	0.00	-0.12	-0.12	-0.11
	Health and social work	4.5	0.01	-0.02	0.01	-0.11	0.44	0.44
	Other services	5.5	0.03	-0.03	-0.03	-0.09	-0.21	-0.20

Source: CGE modelling results

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