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Macroeconomic impact of the COVID-19 pandemic on the Ghanaian economy

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Abstract

The implications of coronavirus (COVID-19) on the various sectors of the economy cannot be overemphasised. To provide the macroeconomic impact of the pandemic on the Ghanaian economy for the next five years, the study adopted the United Nations Economic Commission for Africa (ECA) Macroeconomic model developed for Ghana. The study revealed that by the end of 2020, employment is expected to decline by 6.3 percent, debt to GDP ratio increase to 78.4 percent, fiscal balance reaching negative 13.5 percent, GDP expected to grow at 0.95 percent, expected decline in demand for goods and services and private consumption among others. To minimise the effect of the pandemic on the economy, the government should provide various incentives such as soft loans and tax reliefs to the private sector, reduce export tax to boost export growth and also provide the incentives for value-addition to the country's export among others.

Keywords: COVID-19; macroeconomic model; economy.

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1. Introduction

The onset of the novel coronavirus (COVID-19) has resulted in disruptions in the production and supply chain processes of the world and this has adversely affected several firms and economies. This is mainly as a result of the significant role played by China in the global supply chain processes (McKibbin & Fernando, 2020). Slowing demand, fall in commodity prices and collapses of stock markets show that the effect of COVID-19 goes beyond morbidity and mortality but transcend into economic shocks that could deepen existing income gaps and inequalities in the global economy (Fernandes, 2020; Obeng-Odoom, 2020).

Recent forecasts by the IMF, projects a decline in global economic activities leading to a decline in global growth by 4.9 percent at the end of 2020. This could be attributed to distorted global supply chain, stock market bubble and distortions in global production and economic activities. Economic activities in the Sub-Saharan Africa are expected to contract by 3.2 percent by the end of 2020. This situation, the IMF attributes to weaker external environment and measures taken by various governments in the region to contain COVID-19 pandemic. (IMF, 2020; IMF 2020a; IMF, 2020b). Africa as a whole is also projected to grow between -1.9 percent to -2.7 percent in 2020. Whiles, West Africa is projected to contract by -2.0 percent in 2020, 6 percentage points below the projected growth rate before the pandemic. Prior to the COVID-19 pandemic, the Ghanaian economy, before COVID-19 was expected to grow by 7.2 percent in 2020, however, due to the outbreak of the COVID-19, the economy is expected to grow by 1.5 percent with expected fall in per capita income (IMF, 2020). The expected decline in growth could be attributed to a combination of factors, including a decline in commodity prices, low financial flows, reduced tourism earnings and heightened volatility in financial markets. The deceleration in output growth will also reflect on the negative growth in per capita income of 4.3 percent with the attendant social ramifications.

Given the high concentration of Ghanaian workers in the informal sector, particularly in informal wholesale/retail trade, ongoing restrictions and depressed economic activity risk hitting the economy (Aman, 2020). For example, Ghana's international trade transaction is centred on commodity export. This implies an extreme event that hampers the smooth flow of goods, services and human traffic for business will impact the economy adversely. Thus COVID-19 effect on international commodities prices provides an adverse shock for macroeconomic performance. Ghana's benefits from remittances, tourism, foreign direct inflows, and international aid have also contracted due

to COVID-19. The global projections suggest a decrease of about 30 to 40% in FDIs by UNCTAD (2020, March). Tourism revenue flow is also impacted by the global ban on travel and lockdown which have reduced the demand for leisure and recreation for almost half of 2020.

As a result of COVID-19, various sectors are expected to experience some level of contraction. In curbing the situation, more in particular for sub-Saharan Africa, the IMF recommended the use of fiscal, monetary, and financial policies in ameliorating the negative effect of the pandemic and supporting economic recovery. Similarly, Heathcote *et al*, (2020) also emphasized the need for redistribution of resources to the hardest hit.

Atkeson (2020), Bick and Blandin (2020), IMF (20202a), Coibion *et al* (20202), Fernandes (2020) among others have examined the possible effect of Coronavirus pandemic on the global economy (Hevia & Neumeyer, 2020; McKibbin & Fernando, 2020; Salik, 2020, IMF, 2020a) focusing on advance economies, with a few focus on the African economy. Aman (2020) provides a literature review of the possible impact of COVID-19 pandemic on the economy. United Nations (2020) examined the socio-economic impact on education in Ghana.

Literature is clear about the negative impact of COVID-19 on the economies. Though a negative impact is predicted, the extent and the transmission channels are yet to be examined. It is difficult to estimate the impact of various government interventions (to reduce the impact of the pandemic on individuals and the economy as whole) using various qualitative techniques adopted by Aman (2020) and United Nations (2020). This is because economic agent put up an adaptation behaviour during pandemics which could further affect economic activities. Bloom *et al.* (2005) argued that consumer and investors' confidence are likely to be affected by the pandemic and this could have long term implications for the economy. Similarly, a pandemic has a supply-side effect. Productivity will adversely be affected due to a reduction in labour supply. Other productions are likely to affect real sector negatively (Bloom *et al*., 2005).

In order to address the gap in the literature, the study provides empirical evidence of the macroeconomic impact of the pandemic by using the United Nations Economic Commission for Africa Macroeconomic model developed for Ghana to forecast the impact of the COVID-19 on the performance of the Ghanaian economy. Also, the study provides various scenarios for policymakers to choose the best policy alternative.

2. Review of related literature

The onset of Spanish flu pandemic of 1918 and its associated effect on the living conditions of several European countries have culminated into efforts by several economic researchers to simulate and analyse the effect of a similar pandemic on various economies across the globe. However, a number of these efforts have largely focused on developed western economies.

Keogh-Brown *et al.* (2010a) employed a multi-sector single-country computable general equilibrium model for four European countries (United Kingdom, France, Belgium and The Netherlands) to analyse the macroeconomic impact of the H1N1 flu pandemic for these countries. The paper examined the economic cost of school closure, vaccination and prophylactic absence from work. They found that the pandemic had resulted in a reduction in GDP of these countries by 0.5-2%. When the closure of schools and prophylactic absence from work was considered, the effect more than tripled. Their work is limited in two main ways. First, the only macroeconomic variable they considered was only GDP. They did extend their study to examine the possible effect of the pandemic on other key macroeconomic variables such as the deficit, interest rates, inflation, external balance among others. These variables are key indicators of macro stability and analysing the effect of the pandemic on these variables is key to unravelling the grand effect of the pandemic. Also, the focus of the study on four developed European economies implies that results cannot be generalised to cover African economies that are less developed and prone to the greater adverse effect of any pandemic.

In a similar study, Keogh-Brown *et al.* (2010b) examined the impact of an influenza pandemic on the UK economy using the 'COMPACT' macroeconomic model for the UK. The study extrapolated the sensitivity analysis to cover more extreme disease scenarios. Their analyses indicated that the impact of a repeat of the 1957 or 1968 pandemics, when you allow for school closure, would be ephemeral, constituting a loss of 3.35 and 0.56% of GDP in the first pandemic quarter and a year respectively. Just like their early study, this study was unable to provide the impact of the pandemic on key macroeconomic variables that policymakers can tackle to mitigate the impact of the pandemic on the ordinary person.

Smith and Keogh-Brown (2013) analysed the macroeconomic impact of the pandemic influenza and associated policies in Thailand, South Africa, and Uganda. The reference pandemic used was the H1N1 swine flu pandemic of 2009. Using a single country Computable General Equilibrium model, Smith and Keogh-Brown (2013) simulated the economic impact of the pandemic on

the three economies. The pandemic was found to have caused GDP to reduce by less than 1% in all countries. Though this study considered two African countries, the H1N1 was not as widespread as the current COVID-19. Also, at 2009, a number of economies in Africa were not well integrated into the global trade flow system, hence the impact of a 2009 pandemic would not be the same as the impact of a 2019 pandemic with the well-integrated global economy.

Obrizan *et al.* (2020) analysed the macroeconomic impact of the 1918-19 influenza pandemic on the Swedish economy, using an overlapping generations model. Their model showed that the pandemic caused population to reduce by 0.66%, aggregate consumption by 0.27% for each percentage reduction in population over the following 10 years. In a related study, Barro *et al.* (2020), analyse the effect of a plausible worst-case scenario for the outcomes under COVID-19. Barro *et al.* (2020) drew lessons from the 1918-1920 great influenza pandemic using data from 43 countries. Controlling for the effect of World War I, Barro *et al.* (2020) conclude that the pandemic in today's terms would lead to 150 million deaths and reduction in GDP and consumption by 6% and 8% respectively. Interestingly, the reference pandemic of these two studies could be very misleading. This is because the level of technology, the value of international trade and level of globalisation of the first three decades of the twentieth century cannot be likened to what we have in the twenty-first century. Thus, it is important to analyse the effect of COVID-19 on macroeconomic variables from the perspective of the twenty-first century rather than the twentieth century.

Gräbner *et al.* (2020) discussed the uneven effects of the macroeconomic fallout from the coronavirus and its related economic policy responses. Gräbner *et al.* (2020) showed that the macroeconomic impact of the coronavirus crises was more severe in Southern Eurozone countries than in Northern Eurozone countries. The results of their analysis clearly show that the effect of COVID-19 on various economies cannot just be generalised since economic conditions and macroeconomic stability may be affected by different variables in different countries. Thus, one cannot simply generalise the effect of the pandemic on one country for all other countries.

3. Methods

3.1. Macroeconomic model

The model follows the structural macro-econometric model developed to undertake a sustainable development plan under the auspices of the United

Nation Economic Commission for Africa (UNECA). This model was adapted because it inculcated the foundations for modelling the Ghanaian economy. It follows the techniques and assumptions used by Oxford Economics UK's Global Economic Model developed to calibrate the Ghanaian economy, the International Monetary Fund (IMF) Global Economic Model (GEM) and European Central Bank (ECB) model. The UNECA model, just like the IMF GEM model is highly flexible in structure and it is easy for adaptation to issues at hand. The UNECA is also built on a strong microeconomic foundation which helps to clarify the policy debate by ensuring that the mechanisms at work are well articulated. The UNECA model is a type of multiple time series model that estimates the speed at which a dependent variable returns to its equilibrium after a shock to one or more independent variables. This type of model is useful, as it estimates both the short- and long-run effects of variables (UNECA 2020). It is characterised by a long run neoclassical supply-side and a short run Keynesian demand side. In the long run, each of the economies behaves like the classical one sector economy under Cobb-Douglas technology.

Countries have a natural growth rate, which is determined by capital stock, labour supply adjusted for human capital, and total factor productivity. Output cycles around a deterministic trend, so the level of potential output at any point in time can be defined, along with a corresponding natural rate of unemployment. The demand side agents are the household who consume, save, as well as supply labour and capital services to the firms; firms produce output and hire labour; government implements fiscal policy and a central bank that implements monetary policy – can use short term interest rate or exchange rate policy. The supply-side ensures that prices adjust fully and the equilibrium is determined by supply factors. The model links Ghana to the rest of the world through trade[1], interest rates and exchange rates, commodity prices[2] and the world price of manufactured goods.

Firms are assumed to set prices given output and capital stock, but the labour market is characterized by imperfect competition. Firms bargain with workers over wages but choose the optimal level of employment. Inflation is a typical monetary phenomenon in the long run. All of the models assume a vertical Phillips curve, so expansionary demand policies place upward pressure

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[1.] Exports were driven by the weighted matrix of trading partners' import demand.

[2.] Examples include oil, gas and coal prices depend on supply/demand balance; metal prices depend on growth in industry output.

on inflation. These pressures may cause an unbounded acceleration of the price level. The equilibrium rate of growth in the model is determined by the expansion in the population of working age, capital accumulation and the level of total factor productivity.

The behavioural equations in the model are specified in an Error Correction Model (ECM) framework. All the variables involved are I (1). This method ensures a fitted short-run model to the data and equilibrium in the long run. The policy variables are modelled with flexible options for discretionary actions whenever necessary. The approach allows policy analysis and forecasting to be compressed in the same framework.

3.2. Key assumptions of the model

In developing the model, some key assumptions were made to capture the characteristics of the model to explain how the model will react to economic innovation. These key assumptions include:

a. The model assumes that the long-run growth rate is determined by the supply side factors-productivity, labour and capital – and attempts to raise growth by boosting demand, only leads to higher prices. The economy behaves like the classic one sector economy under Cobb-Douglas technology where the level of potential output at any point in time is defined by the capital stock, labour supply adjusted for human capital, and total factor productivity;

b. Changes in wages are fully passed through to prices and real wage is determined by productivity growth;

c. Investment equations are underpinned by the Tobin's Q ratio, such that the investment rate is determined by the return relative to the opportunity cost, adjusted for taxes and allowances.

d. Consumer spending is assumed to be consistent with Life Cycle/Permanent Income theories where spending patterns change over the course of an individual's lifetime;

e. In the long run, inflation is seen as a monetary phenomenon, the vertical Phillips curve is assumed and implemented. This implies that expansionary demand policies place upward pressure on inflation. This means policymakers cannot stimulate the economy without consequence in terms of higher inflation. Due to the negative consequences of inflation, the monetary policy variable is modelled as endogenous. The monetary policy is underpinned by Taylor's

rule, captured using an inflation target, such that interest rates are assumed to rise when inflation is above the target rate, and/or output is above potential;

f. Exports of countries are assumed to be small (in the global market) and determined by aggregate demand so countries can't determine their term of trade. Trade volumes are combined with price indices to partially determine the current account balance;

g. Expectations are modelled as an adaptive process which makes the model susceptible to the Lucas Critique. To address the issue, exogenous variables are assumed to be known as a prior variable.

3.3. Key equations characterising the model

The model is structured into four main sectors with several underpinning sub-sectors. These together generate an equilibrium position (aggregate demand and supply) of the model and they are linked through equations (behavioural and identities) to form a system. We, therefore, present the various equation blocks which constitute the model.

Demand-side policies

The aggregate demand is modelled as an identity relationship, summing the components of expenditure (private consumption ($CONS_t$), investment (IF_t), government consumption (GC_t), stock building (SCR_t), exports (X_t) less imports (M_t). Export deviations are modelled as part of the global linkage system of the model. The aggregate demand equation is given as:

$$AD_t = GDP_t = CONS_t + IF_t + GC_t + SCR_t + X_t - M_t \quad (1)$$

with GDP_t being the real GDP of the economy. We postulate that, in the short-run, output is determined by the country-wide demand which can deviate from its potential level of supply. These deviations are measured by the output gap which is defined as the ratio of actual to potential output.

Private consumption expenditure (CONS)

The dynamic specification of household consumption expenditure is modelled as a continuum of households who consume a bundle of goods and also supply labour services to all the sectors of the economy. The private consumption expenditure is estimated with weight and could be endogenized for experimental purposes. Households are made up of a share that can access the financial markets, trade in government bonds, accumulate physical capital and rent capital services to sectoral firms. They partially smoothen their consumption over their life cycle.

The household consumption expenditure is determined by population growth and maintaining a constant rate of per capita consumption. Households are allowed to respond to inflation uncertainties in the short-run with a stabilising mechanism that tries to lower the inflationary gaps. The remaining households do not have access to the financial markets and consume all their disposable income. These households also supply the bundle of labour services that firms demand in the economy at a wage rate. This simple Keynesian relationship between disposable income and consumption is expressed as:

$$\Delta logCONS_t = \varphi_0 - \gamma[logCONS_{t-1} - logPEDY_{t-1}] + \varphi_1 \Delta logPEDY_t + (1-\varphi_1)\Delta logPOP_t + \varphi_1 INFGAP_t \quad (2)$$

where $CONS_t$ denotes country-specific consumption expenditure, $PEDY_t$ is real personal disposable income, POP_t is population and $INFGAP_t$ is inflationary gap which is measured as the difference between actual and expected inflation level a period ahead. Real disposable income is adjusted to take into account the terms-of-trade impact on income.

Firm and investment behaviour (IF)

Investment in the model follows a simple accelerator model which links investments to terms-of-trade adjusted to GDP. The trade adjustment term helps to cushion the model against a drop in commodity prices on investment in the commodity market. The investment equation also incorporates a lagged dependent variable that allows for persistence to capture the highly cyclical nature of investment.

$$\Delta log(IF_t) = \varphi_0 - \beta_1[log(IF_{t-1}) - \log(GDI_{t-1})] + \varphi_1 \Delta \log(GDI_t) + \varphi_2 \Delta log(I\Delta F_{t-1}) \quad (3)$$

with IF_t representing the volume of gross fixed capital formation and GDI_t being the gross domestic income or terms-of-trade adjusted GDP. Gross capital formation (investment) depends on gross domestic income (GDI_t), household consumption expenditure, government consumption, exports of goods and services given the deflator.

Government consumption expenditure (GC)

Government consumption is determined by capacity or potential output and gross domestic income. In some instances, it is set exogenously (as a policy variable) as part of the process of constructing a forecast baseline which corresponds to current government consumption plans. In case there are no government spending plans, a simple model equation is applied to maintain the share of government spending in aggregate demand. With this in mind, we modelled the government

spending as a weighted average of potential output growth and term-of-trade adjusted GDP growth.

$$\Delta log(GC_t) = \upsilon \Delta log(YHAT_t) + (1-\upsilon) * \Delta log(GDI_t) \quad (4)$$

where GC_t is the volume of government consumption expenditure which feeds directly into both GDP identity and government budget balance with a weight (υ).

Real Inventory Change (SCR)

The inventory change or stock building in this model is a function of the population and the gross domestic product or as the residual on the national income accounting. As such, it also takes into account any discrepancies that arise from the various national income accounting approaches. The inventory equation is specified as:

$$SCR_t = SCR_{t-1} - \vartheta \left[SCR_{t-1} - \left(log\left(\frac{POP_t}{POP_{t-1}}\right) + \chi \right) GDP_{t-1} \right] \quad (5)$$

SCR_t represents the volume of inventory accumulation, parameters ϑ and χ are estimated for each to ensure the stability of the model.

International Trade (X-M)

International trade variables serve as the bilateral trade sensitivities and also provide the global linkages to the model. Trade variables are modelled on the assumptions underlying bilateral trade matrix that captures bilateral trade flows between Ghana and other countries.

The import demand function is specified following the imperfect substitute framework. Under this assumption, real import demand is determined by expenditure from all the economic agents[3] and imports which are not perfect substitutes for domestic goods. We also take into consideration the price of import relative to domestically produced goods and services. The import function is defined specifically as:

$$\Delta logM_t = \phi_0 - \beta \left[logM_{t-1} - \alpha_1 logTFE_{t-1} - \alpha_2 log\left(\frac{PMGNOIL_{t-1}}{PGDP_{t-1}}\right) + \phi_1 \Delta logX_t + \phi_2 \Delta logCONS_t + \phi_3 \Delta logIF_t + \phi_4 \Delta logGC_t \right] \quad (6)$$

where M_t is the volume of imports of goods and services, TFE_t is the total final expenditure defined as GDP plus imports, $PMGNOIL_t$ is the non-oil import price deflator in US$ and $PGDP_t$ is the GDP deflator. The long-run income elasticity parameter β is restricted to fall between 1 and 1.2 to allow for further globalisation while ensuring the long-run stability of the model (Hong, 1999).

[3] Households, firms, government and the external sector.

Oil price is excluded from the price of imports, as it tends to be highly volatile, while the price elasticity of oil demand is usually very low. This allows for more reliable estimates of the price effects on real import demand.

Exports rest on two simplifying assumptions: a weighted average of import demand with its trading partners, and any shift in competitiveness which may affect the country's export market share. If demand for imports rises and relative export prices remain unchanged, we would expect exports to rise proportionally to their historical share. In this very simple scenario, export shares would remain constant in both value and volume terms. However, as soon as export prices are allowed to diverge, an explicit assumption must be made on the sensitivity of trade volumes and values to relative prices. The functional form follows as:

$$\Delta logX_t = \Delta logWDR_t + (1 - OXS_t) * \left(\frac{\phi_0 \Delta logPMGNOIL_t}{WT_t} + \frac{\beta \Delta logPXGNOIL_{t-1}}{WT_{t-1}} - \alpha \Delta logPXGNOIL_{t-2}\right) + logX_{adj} \quad (7)$$

where X_t is the volume of exports of goods and services, WDR_t is global demand for goods and services, OXS_t is the oil share of export, $PXGNOIL_t$ is non-oil export price deflator, WT_t denote global prices and X_{adj} denotes export adjusted to world prices.

Supply-side policies

Supply-side policies are market-oriented and interventions that are designed to increase long-run aggregate supply or full employment level of output. It normally follows Neo-Keynesian and Neo-classical economic perspectives. As it is widely known, the supply side of every economic model determines the long-run growth path of the economy which is critical to the model's performance. Moreover, the interaction between aggregate demand and potential output determines the state of the cycle and the direction of the gap between aggregate demand and potential output.

In our model, the supply side is represented by the productive capacity of an economy which we define by a production function that maps the factor inputs to the final output. By way of conventional wisdom, the model adopted two factors of production of the form:

$$YHAT_t = f(K_t, L_t, A_t) \quad (8)$$

where $YHAT_t$ denotes potential output, K_t is the desired capital stock, L_t is potential labour input and A_t indicate the state of technology which we represent as the

total factor productivity (TFP_t). To construct a baseline forecast, potential labour inputs evolve with labour force projections (LS_t) measured as the participation ratio and total population above 15 years. Using total differentials and assuming perfect competition in the factor markets; and a homothetic production function, the growth of potential output can be expressed as a weighted sum of the factor share and the growth of total factor productivity. Under the assumption of constant returns to scale, we decompose the growth of potential output as:

$$\Delta \log(YHAT_t) = \Delta \log(LS_t) + \Delta \log(PRODT_t)$$
$$PRODT_t = \theta_{K_t} \Delta \log(k_t) + \Delta A_t \quad (9)$$

where $PRODT_t$ is trend labour productivity and k_t is the capital per unit of labour input (K_t/LS_t). In most studies, the trend rate of labour productivity can be endogenized and linked to factors that determine capital deepening and total factor productivity growth like the rate of innovations. The trend labour productivity growth is modelled as a simple ARDL model which allows us to avoid the need for an explicit capital stock for which there is very limited data for most developing countries. This equation breakdown potential output growth into contributions from potential labour inputs and trend labour productivity which could further decompose into total factor productivity growth and the rate of capital deepening. The equation above forms the basis of the supply-side trajectory for each country modelled.

To account for potential market imperfections between external demand and domestic supply especially in developing countries and those practising fixed exchange rate regimes, export growth is incorporated into the model to serve as an explicit link to potential output. This leads to a modified potential output equation expressed as:

$$\Delta \log(YHAT_t) = \alpha[\Delta \log(LS_t) + \Delta \log(PRODT_t)] + (1-\alpha)\Delta \log(X_t) \quad (10)$$

where X_t is the volume of export of goods and services, and α is an estimated weight and it is normally 0.9 or above. Labour force projections are modelled to constituteprojections for the population aged 15+ and labour force participation. Labour force participation equation in the model incorporates an automatic stabilising relationship which guarantees that trend labour productivity growth does not drift too far from actual average labour productivity growth expressed as:

$$PART_t = PART_{t-1} + \alpha_1 \left[\Delta \log\left(PRODT_{3yr-avg}\right)_{t-1} - \Delta \log\ PRODT_{t-1}\right] * 100 \quad (11)$$

with $PRODT_{3yr\text{-}avg}$ being the labour force productivity 3-year on average. This automatic adjustment mechanism can also be found in the trend labour

productivity equation given as:

$$\Delta \log PRODT_t = \beta_1 \Delta \log PRODT_{t-1} + \beta_2 TREND_t + \alpha_1 \left[\Delta \log\left(PRODT_{3yr-avg}\right)_{t-1} - \Delta \log\ PRODT_{t-1}\right] \quad (12)$$

where $TREND_t$ is an exogenous parameter for the long-run trend rate of productivity growth which is normally set to 0.04 per annum for least developed countries, 0.02 per annum for high-income countries and 0.03 per annum for all other countries.

Trade price and current account

The current account balance is modelled as an identity relationship that sums net trade in the US dollars with a residual category that captures primary and secondary income flows. Tradeprices are decomposed into the global price of oil (set as exogenous) and the price of all other traded goods and services. Total exports (PXG_t) and import (PMG_t) of goods and services deflators are modelled as a weighted average of the global oil price ($WLDPOILU_t$) and non-oil import/ export deflators ($PMGNOIL_t$ or $PXGNOIL_t$) which captures the price of all non-oil exports/imports in US$. Deflators for total export and import of goods and services are respectively given as:

$$PMG_t = (\upsilon_1 PMGNOIL_t + (1-\upsilon_1) WLDPOILU_t) * RXD_t$$
$$PXG_t = (\nu_1 PXGNOIL_t + (1-\nu_1) WLDPOILU_t) * RXD_t \quad (13)$$

where RXD_t is the exchange rate, υ_1 and ν_1 are weights calibrated from historical trade patterns and are constants for the forecast baseline but can also be changed to allowing the model to capture a decreasing or increasing weight of oil in a country's trade composition. Global non-oil export prices error corrects on a weighted average of domestic prices and global prices WT_t. Both short-term and long-term weights are estimated to allow the model to capture the pricing power of the country. The global non-oil export deflator is given as:

$$\Delta logPXGNOIL_t = \Delta logRXD_t - \kappa_1 \left((logPXGNOIL_{t-1} * RXD_{t-1}) - \kappa_2 logPGDP_{t-1} + (1-\kappa_2) * log\left(\frac{WT_{t-1}}{RXD_{t-1}}\right)\right) + \kappa_3 \Delta logPGDP_t + (1-\kappa_3)\Delta log\left(\frac{WT_t}{RXD_t}\right)$$
$$\Delta logPMGNOIL_t = \Delta \log(CMUD_t) + \Delta logRXD_t \quad (14)$$

where $CMUD_t$ is the country's non-oil import price in US dollars.

Government policy instrument

The policy instrument components of the model allow us to address a range of policy questions including both monetary and fiscal policies instrument. The monetary policy component is modelled either through interest rate dynamics with a freely floating exchange rate modelled through interest rate differential relative to the US. Ghana being an oil-exporting country also takes into account an estimated relationship between the exchange rate and oil price movement, while, short-term interest rate policy is also included in the model. The policy rate follows a simple Taylor rule specification determined by both inflationary and the output gaps. In specifying the policy function, we include a lagged dependent variable to allow for persistence in the level of the interest rate, which will converge to the country steady-state rate overtime.

On the other hand, fiscal policy rule is introduced to ensure that the deficit and debt stock return to sustainable levels after any shock. This generally takes the form of a feedback loop between the deficit or debt stock on the tax rate, so that a deviation from the targeted level of the debt or deficit initiates an automatic adjustment in the tax rate which widens with the size of the government debt to GDP ratio. The government budget balance (GLN) is expressed as an identity relationship that sums total government revenue (GREV), government consumption spending and a residual category that captures all other spendings (GEXPOTH). The growth rate of total government revenue is modelled as a weighted average between GDP and export (in nominal prices). The weights capture the export sensitivity of government revenue in Ghana.

Sources of data

On data, the study updated the data in the model developed for Ghana by the UNECA. The data is sourced from both national and international bodies such as Bank of Ghana, Ghana Statistical Service, World Bank among others. The source of each variable used the model is presented in Appendix 1.

Assumptions for the simulation

To estimate the model and examine the impact of COVID-19 on the economic performance of Ghana, certain empirical assumption was made as shown in Table 1. The labour force is projected to be decreased by 6.1%. At the baseline assumptions, The GSS (2020) in it COVID 19 trackers suggest employment decline by 6.1%. Government spending as of June 2020, has increased by 11.5% and revenue decreased by 26% (MOF, 2020). In the first scenario, the non-oil

price is expected to decrease by 5%, non-oil import price index decreased by 1% while non-oil export index is expected to decrease by 7.5%. The World Bank (2020) projected that investment for sub-Saharan Africa is expected to decrease by 15% due to COVID-19.

Table 1: Simulations Assumptions

Shock Variables	Scenario 1	Scenario 2
Labour force	-6.1%	-6.1%
External demand	-7.5%	-7.5%
Oil price	US$ 35	US$ 35
Non-oil price	-5%	-5%
Non-oil export price index	-7.5%	-7.5%
Non-oil import price index	-1%	-1%
Investment	-15%	-15%
Government revenue	-26%	-26%
Government expenditure		GH₵10 billion

Government consumption is expected to further increase due to the planned intervention of Government through the COVID Alleviation and Revitalisation of Enterprises Support (CARES) programme. The CARES programme is expected to inject about GH₵100 billion into the Ghanaian economy through enterprises (MOF, 2020) over the next three years. Out of this amount , the Government of Ghana (GoG) is expected to raise about GH₵30 billion. Since the CARES programme is over three years, it is expected that GoG would raise GH₵10 billion of this amount yearly. The assumption made in this paper in scenario two was to examine if the government spends the first GH₵10 billion in the second half of 2020.

4. Results and discussion

Table 2: Baseline Forecast without COVID-19 Shocks

	ACTUALS				FORECASTED				
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Real GDP Growth	3.93	7.58	8.25	6.23	6.25	6.50	6.68	6.85	6.89
Inflation	18.33	13.90	12.75	12.07	11.61	11.34	11.18	10.80	11.35
Fiscal Balance	-6.53	-7.32	-8.36	-9.31	-9.95	-10.62	-11.25	-11.78	-12.33
Debt to GDP	90.26	79.69	73.49	71.00	69.87	69.59	69.92	70.79	72.01
Private Consumption	81.54	81.43	81.86	81.05	80.41	80.06	79.88	79.89	80.05
Import to GDP	41.20	40.05	39.33	38.93	38.52	38.18	37.96	37.99	38.07
Export to GDP	36.42	35.33	34.09	33.65	33.23	32.76	32.29	31.96	31.68
Employment Growth	2.71	3.06	2.71	2.69	2.67	2.81	2.72	2.73	2.71
Actual Employment	337.59	390.64	357.38	364.70	370.51	400.40	398.53	410.64	419.56
Current account to GDP	-0.55	-0.38	-0.31	-0.24	-0.17	-0.13	-0.11	-0.09	-0.08
Capital Account to GDP	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01

Table 3: Scenario 1 - Responses of some seleceted Macroeconomic Variables with COVID-19 Shocks

	ACTUALS				FORECASTED				
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Real GDP Growth	3.93	7.58	8.25	6.23	0.95	2.28	3.95	4.34	3.61
Inflation	18.33	13.90	12.75	12.07	8.12	9.74	10.30	12.53	13.33
Fiscal Balance	-6.53	-7.32	-8.36	-9.31	-13.1	-14.5	-15.8	-17.1	-18.7
Debt to GDP	90.26	79.69	73.49	71.00	78.53	82.55	86.59	91.20	94.71
Private Consumption	81.54	81.43	81.86	81.05	78.36	77.30	76.83	76.32	76.55
Import to GDP	41.20	40.05	39.33	38.93	31.36	31.14	30.96	30.86	31.02
Export to GDP	36.42	35.33	34.09	33.65	22.67	21.98	21.15	20.22	19.31
Employment Growth	2.71	3.06	2.71	2.69	-6.33	0.80	2.92	2.78	2.76
Actual Employment	337.59	390.64	357.38	364.70	-844.07	1099.84	397.71	388.84	396.41
Current account to GDP	-1.00	-0.76	-0.71	-0.59	-0.61	-0.56	-0.51	-0.47	-0.45
Capital Account to GDP	0.035	0.027	0.024	0.020	0.017	0.014	0.012	0.009	0.007

Table 4: Scenario 2 - Responses of some seleceted Macroeconomic Variables following COVID-19 Shocks and Government Intervenation

	ACTUALS				FORECASTED				
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Real GDP Growth	3.93	7.58	8.25	6.23	1.25	1.58	3.39	3.80	3.76
Inflation	18.33	13.90	12.75	12.07	10.52	10.95	11.59	10.38	11.42
Fiscal Balance	-6.53	-7.32	-8.36	-9.31	-12.86	-14.21	-15.53	-16.80	-18.84
Debt to GDP	90.26	79.69	73.49	71.00	78.00	83.76	89.26	94.34	99.22
Private Consumption	81.54	81.43	81.86	81.05	79.20	78.02	77.13	76.35	76.23
Import to GDP	41.20	40.05	39.33	38.93	31.84	31.46	30.97	30.82	30.48
Export to GDP	36.42	35.33	34.09	33.65	22.88	22.38	21.72	20.88	20.22
Employment Growth	2.71	3.06	2.71	2.69	-6.28	8.64	2.90	2.74	2.75
Actual Employment	337.59	390.64	357.38	364.70	-837.84	1080.25	394.64	383.40	394.75
Current account to GDP	-0.94	-0.70	-0.70	-0.57	-0.65	-0.57	-0.50	-0.46	-0.39
Capital Account to GDP	0.031	0.022	0.019	0.017	0.014	0.012	0.010	0.009	0.007

Table 2 presents the baseline results on inflation, private consumption and employment. Results on the impact of COVID-19 and what happens to these variables over the next five years when government intervenes is also presented in Table 4. The rate of inflation is expected to decline as a result of the pandemic. The inflation rate of 11.6 percent from the baseline model is expected to decline to 8.1 percent as a result of the pandemic. The decline in the rate of inflation could be attributed to the reduction in the demand for goods and services as a result of the pandemic. The Ghana Statistical Service (2020) in its first wave of COVID-19 Households and Jobs Tracker revealed that 77.4 percent (approximately about 22 million Ghanaians) of Ghanaian households experienced a reduction in income in March as result of the COVID-19 restrictions. The reduction in income levels would adversely affect demand for goods and services and hence reduce demand pressures on prices in the country leading to the reduction in the rate of inflation the country would experience. The rate of inflation is expected to start going up from 2021 as a result of the expected reduction in the adverse effect of the pandemic on demand for goods and services in the economy. The trajectory of the rate of inflation changes when the planned intervention of Government through the COVID Alleviation

and Revitalisation of Enterprises Support (CARES) programme is taken into account. The CARES programme is expected to inject about GH₵100 billion into the Ghanaian economy through enterprises (MOF, 2020) over the next three years. Out of this figure, the Government of Ghana (GoG) is expected to raise about GH₵30 billion. Since the CARES programme is spread over three years, it is expected that GoG would raise GH₵10 billion of this amount on yearly basis, hence when this is taken into account, you realise that it changes the path of inflation from the COVID-19 trajectory and it would cause inflation to increase from 8.1 percent (which is a result of COVID) to 10.5 percent for 2020. This implies that the GH₵10 billion intervention by the GoG assuming it was implemented this year could move inflation rate back to pre-COVID-19 levels. This is because enterprises that would benefit from such support are likely to restore production to pre-COVID levels and re-employ individuals who previously lost their jobs as a result of COVID and it improves their demand for goods and services which eventually contributes to price increases in the economy.

Private consumption is expected to decline by 2.05 percent from the baseline forecast of 80.41 percent. The decline in private consumption could be a result of the reduction in incomes which occurred as a result of COVID-19. The CARES intervention could contribute to improving private consumption by 0.84 percent, which is better than private consumption which the nation would record in 2020 as a result of COVID-19 though it would still be less than the expected forecast value of 80.06 before COVID-19 struck the nation. It is important to note that, if GoG fails to provide the GH₵10 billion CARES fund for the three years as promised in the 2020 mid-year budget review, private consumption would see a continuous decline and follow the same trajectory as the COVID-19 affects private consumption (see Table 2). This implies that the effect of COVID-19 on the Ghanaian economy (at least in terms of private consumption) could last more than four years. The GH₵10 billion CARES intervention for the next three years may not be enough to revive the Ghanaian economy from the effects of the coronavirus. There is the need for policies that would encourage private consumption which could have a multiplier effect on employment, income levels, production and ultimately GDP. There is the need for reduction in income tax levels, which would necessarily require a revision in the tax exemption regime of the country in order to close the gap that would be created by the tax reduction in the income tax. The provision of free electricity to households should rather be channelled to private enterprises and manufacturing firms to

enable them to maintain levels of employment in the face of COVID-19. This would ensure that individuals and firms can maintain their purchasing ability to improve private consumption and enhance productivity.

Concerning employment, the baseline forecast indicates that employment was expected to increase by 2.67% (i.e. equivalent of 371 thousand new jobs) in 2020 without COVID-19. However, with the onset of COVID-19 with its associated adverse effect on consumption and productivity due to various restrictions placed by the government, employment is expected to decline by 6.33 percent (the equivalent of 844 thousand jobs lost) in 2020 with COVID-19. This forecast is consistent with the findings of the field survey by the Ghana Statistical Service for the COVID-19 Households and Jobs Tracker 2020. The CARES intervention by government would only improve employment from the COVID-19 level by only 0.05 percent (the equivalent of about six thousand new jobs). This is woefully inadequate to restore employment to pre-COVID-19 level. Assuming the private sector reneges on contributing the GH₵70 billion of the CARES intervention and the intervention is done as a one-off intervention of GH₵10 billion, then, it would take Ghana up to 135 years to restore employment to pre-COVID 19 levels. However, since the private sector would undertake some form of investment after COVID-19, employment is expected to pick up by 2021. Thus, for Ghana to experience employment growth, there is a need for a continuous government and private sector intervention in the production of goods services.

Table 2 shows that the Ghanaian economy before COVID-19 was experiencing improved GDP growth levels from 2016-2019, however, taken the impact of COVID 19 into account indicates that our GDP is going to shrink drastically to 0.95 percent in 2020 compared to the figure of 6.25 percent baseline value. This raises concerns as to what the Ghanaian government is going to do to overcome this fall. Our simulations also indicate that the growth level will begin to rise again from 2.3 percent in 2021 through 4.3 in 2023. The forecasted results are highly supported by a wide range of literature and estimates by the development institutions like the UNECA, World Bank and the IMF. For instance, the World Bank has predicted an annual GDP figure of 6.7 percent in 2019 and 1.1 percent in 2020 given the pandemic while IMF has also forecasted 6.1 percent in 2019 and 1.1 percent at end of 2020 for the Ghanaian economy. Africa Development Bank (AfDB) additionally forecast that Ghana's economy would continue to expand in 2019, with real GDP growth estimated at 7.1 percent which constitutes a high growth momentum

since 2017 placing Ghana among Africa's 10 fastest-growing economies. However, this figure is now estimated to shrink below African's growth level of -3.4 percent following the pandemic. World Bank's macro poverty outlook also projected a GDP growth of 1.5 percent for 2020. These figures reinforce the growth levels obtained by our simulations that COVID 19 pandemic would impact the Ghanaian economy by lowering growth levels. These estimates are expected given the effects of the COVID 19 pandemic included but not limited to borders closures, the lockdown of the two main cities in the country and the subsequent slowdown of economic activities.

With respect to fiscal balance, our simulation forecast a deficit of -13.1 percent of GDP in 2020 following COVID 19 pandemic as compared to the 9.95 percent deficit forecasted for 2020. As reported in Table 3, the effects of the pandemic would further deepen our deficit if prudent macroeconomic policies are not put in place to curtail revenue loss and increment in government expenses. To further deepen our forecast, the World Bank macro poverty outlook also forecasted a fiscal deficit of -9.0 in 2020 and -7.1 in 2021. According to the government of Ghana budgetary operations, the economy's fiscal deficit would end at 3.4 percent of GDP which is significantly higher than the target of 1.9 percent of GDP which was mainly due to the slow pace of revenue mobilisation as a result of the pandemic and the subsequent increases in government expenditure which went up by 33 percent of GDP due to unbudgeted COVID-19 containment measures. For instance, the government of Ghana following the COVID-19 pandemic allocated US$100 million to cater for the pandemic and its related issues. Part of this allotment went into the provision of PPEs for frontline workers consisting of health and educational workers, assurances for health workers, absorption of part of electricity tariffs and full water bill for April to September 2020. The government has also constructed a 100-bed emergency health facility to house individuals who may contract the virus.

Additionally, our simulations also presented a 78.4 percent debt-to-GDP ratio in 2020 and a further increase in the coming years. This is supported by the World Bank macro poverty outlook which also forecasted 73 percent of GDP in 2020. Moody's recently predicted Ghana's debt-to-GDP to hit 70 percent in 2020 which is higher than the forecasted figure of 64 percent in 2019. The rating agency further indicated that the US$3 billion Eurobond issuance in January 2020 and the US$1 billion disbursements under the IMF's Rapid Credit Facility to help address the urgent fiscal and balance of payments needs that Ghana is facing and also to improve confidence and catalyse support from other

development partners. IMF, on the other hand, is projecting a debt-to-GDP ratio of 68.7 percent in 2020 which falls in the range of what most literature reports.

The response of shock due to COVID-19 and the associated government interventions is also presented in Table 4. Export and imports are expected to decline to 22.67 and 31.36 respectively as a result of the pandemic from the baseline model. The slowing down in global growth is one key factor that affects the trade balances of the economy. Falling demand due to the temporary or permanent shutdown of industries and major trading partners and fallen global income has affected the export and import of the country. The global market is estimated to decline coupled with declining demand for commodity export from Sub-Saharan Africa account for the decrease in export activities. MOF (2019) also hinted a possible decline due to anticipated slowdown of Ghana's major trading partners, China, and Euro area which accounts for 50% of Ghana's total trade. Import decline is attributed to a disruption in the global value chain, decline production from the importing countries, and halt in transportation because of COVID-19 protocol to slow down the spread of the virus. The trajectory of export and import does not change much even if the government planned investment of additional GH₵10 billion. Export increases by .21% while import only increased by .48% in 2020. The forecasted trend suggests a continuous decline in export and import over the forecasted period. This shows that the GH₵10 billion CARE injection may not be enough to boost export and imports. Given that most imports in the Ghanaian economy are done by the individual business which has been affected by the pandemic. Thus, the closing of individual domestic businesses as indicated by the GSS (2020) COVID-19 business tracker which would lead to a decline in import demand for the Ghanaian economy as a result of COVID-19. However, in the case of export, commodity demand by the international market may be a key factor to improve export by other countries. Therefore, increase government consumption may have less impact on the recovery of export due to the pandemic since Ghana is a small open economy and mainly depends on commodity export.

Current account as a ration to GDP is expected to worsen from .17% to 0.61% in 2020 due to the pandemic compared with the baseline. The increased negative balance of current account could be attributed to the decline in commodity export due to the global pandemic. It must be emphasized that, if the state of affairs continues, the current account balance improves gradually from its previous performances to -.45% in 2024. If the government spends the GH₵10billion injection in the second half of 2020, the current account

will increase by 0.04% in 2020. Given the dwindling of commodity demand, enterprises that received support from the government may engage in the import of goods given the easing of the economy and trading partners economy. Even firms that are engaged in productive activity may import essential inputs for their production accounting for the slight increase in the current account deficit in 2020. Similarly, Table 3 shows that the capital account balance decrease from the baseline of 0.02 to 0.017 in 2020 due to the pandemic. The downward trends in the capital account are projected to continue through the forecasted periods. This decline in the current account is due to the dwindling of international inflows of capital due to the pandemic. The government's planned injedction in response to COVID-19 failed to lead to an increase in the current account but further, worsened by 0.003% to 0.014%. This forecast behaviour in the capital account is not surprising due to short-falls in the various capital inflows.

5. Conclusions and policy implications

The paper employed the United Nations Economic Commission for Africa Macroeconomic model developed for Ghana to generate a five-year forecast on the impact of the COVID-19 pandemic under different scenarios. The forecast was based on key macroeconomic variables such as growth, inflation fiscal balance, debt to GDP ratio, private consumption, employment, and the external sector. The forecast of the model indicated that growth of the country would be around 0.95% in 2020 and subsequently pick up in 2021 to about 2.28%. the fiscal balance position of the country would also deteriorate in 2020 as a result of the pandemic. Our forecast however indicates that this trend is likely to continue in the next five years. Generally, our study has revealed that, without government intervention, COVID-19 is more likely to cause serious havoc to the Ghanaian economy, however where government intervention is well targeted, then it is likely to help mitigate its adverse effect of the pandemic.

The outcome of our study implies that there is the need for government to look for innovative ways to increase revenue mobilization in order to reduce the possible rise in fiscal imbalance. The COVID-19 Alleviation and Revitalization of Enterprise Support (CARES) programme should be deligently implemented to help private enterprises to revive their businesses in order to reduce unemployment, increase revenue mobilization sources and enhance growth of the economy. Increase in employment is more likely to increase private consumption, which per our forecast would see continuous declines in the next fives. Also, the government must ensure an enabling environment

such as reducing the export tax to boost export growth, providing the enabling environment attracts inflow of foreign capital to boost capital account through FDI, capital investment, provide an incentive to encourage value-addition for export and promote tourism among others.

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Appendices

Appendix 1: Sources of Data

CODE	Definition of variables in the model	Sources
	Demand Block	
	Demand block - Real	
GDP	GDP, Real, LCU, Millions	WDI
CONS	Household Consumption Expenditure, Real, LCU, millions	WDI
GC	General Government Consumption, Real, LCU, millions	WDI
IF	Gross Fixed Capital Formation, Real, LCU, millions	WDI
M	Imports, goods & services, real, LCU, Millions,	WDI
X	Export of Goods and services, Real, LCU	WDI
SCR	Real Inventory Change, Real, LCU	WDI
TFE	Total final expenditure, Real, LCU	WDI
	Demand block - Nominal	
GDP1	GDP, nominal, LCU, Millions	WDI
M1	Imports, goods & services, nominal, LCU [Millions]	WDI
X1	Exports, goods & services, nominal, LCU [Millions]	WDI
	Supply Block and Labour Market Block	
ET	Employment, total [Thousands]	ILO
LS	Labour Force [Thousands]	ILO
PART	Labour Force Participation [Rate]	ILO
POP	Total population [Thousands]	ILO
POP15	Population 15+[Thousands]	ILO
U	Unemployment Rate	ILO
PRO	Productivity	Ghana Statistical Service
PRODT	Technology trend (trend productivity)	Authors computations
TFP	Trend productivity growth	Authors computations
YHAT	Capacity output, LCU	Authors computations
	Trade and Commodity Block	
BCU$1	Current Account Balance, nominal, US$, millions	WDI
BCUS$1OTH	Other items for current account, Nominal, US$, millions	WDI
BTN	Trade Balance, nominal, US$, millions	WDI
OMS	Oil Share of Import, Nominal, US$, millions	Commodity Trade Statistics
OXS	Oil Share of Export, Nominal, US$, millions	Commodity Trade Statistics
CMUD	Non-oil imports, Nominal, US$, millions	Commodity Trade Statistics
WDR	Country Specific Global Demand	Commodity Trade Statistics

	Fiscal and Monetary Block	
GEXPOTH	Government expenditure, Others, capital, nominal, LCU, Millions	Ministry of Finance
GLN	General Government Net Lending, (fiscal balance), nominal, LCU, millions	Ministry of Finance
GREV	Government revenue, total, nominal, LCU, Millions	Ministry of Finance
GGDBT	Government Debt, total, nominal, LCU Millions	Ministry of Finance
PEDY	Real personal disposable income, Real, LCU	Ghana Statistical Services
ATAX	Total government revenue as a share of GDP	Ghana Statistical Services
RCB	Monetary policy rate	Bank of Ghana
M2	Money supply	Bank of Ghana
	Prices and Deflators	
CPI	Consumer Price Index	Bank of Ghana
PMGNOIL	Non-Oil Import Price Deflator, LCU	WDI
PXGNOIL	Non-Oil Export Price Deflator US$	WDI
PGDP	GDP Deflator, LCU	Bank of Ghana
PMG	Deflator for Imports of Goods and Services, LCU	WDI
PXG	Deflator for Export of Good & Services, LCU	WDI
	Exchange Rate	
RXD	Exchange rate, period average [LCU per US$]	Bank of Ghana
	World Variables	
WD_POILU	World oil price, Brent crude spot, $pb [US$ per barrel]	WDI
WT	Global non-oil export price, US$	WDI