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Socio-economic Impact Analysis of COVID-19 in Ethiopia



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Table of contents

1	Introduction	4
2	Definition of scenarios	7
3	Simulation results	10
3.1	World economy and main trading partners	10
3.2	Optimistic scenario	12
3.3	Pessimistic scenario	16
3.4	Worst-case scenario	19
4	Conclusion and policy recommendations	22
5	References	23
Appendix I	The HERMIN macroeconomic model	24

1 Introduction

As of now there is no doubt that the COVID-19 global pandemic will have nontrivial consequences for developing economies. Even if the disease itself does not spread heavily or does so with significantly less health damage than expected, and with no severe lockdowns imposed by governments, developing economies will still face a significant slowdown in their GDP growth, at best. A decline in GDP, however, seems more probable. That will unquestionably lead to a rise in poverty and worsening of many health and social indicators. The latter will be exacerbated by a rather limited room for fiscal manoeuvring given the low ability to collect revenues and low potential to borrow both domestically and internationally. Facing lower revenues driven by slowing economic activity, governments are likely to be unable to prevent cuts in expenditures unless they receive extended grants and credits from development partner or move to monetary financing. Naturally, the latter can easily lead to massive depreciations and runaway inflation.

Any analysis aspiring to assess the impact of the COVID-19 pandemic on measures of welfare, poverty and other social and health indicators must rely on macroeconomic scenarios that consistently evaluate expected trajectories of key macroeconomic variables. These include the real GDP and its components from the demand and production sides, employment, inflation, exchange rate, interest rates, and other variables depending on the availability of the data. Real GDP and employment serve as entry variables for the construction of many poverty and welfare indicators, while the nominal GDP, the exchange rate and the interest rate are inputs in the estimation of budget revenues and expenditures, and the assessment of debt sustainability. Knowledge of these allows us to assess the fiscal space available for social programs, which loop back to measures of welfare and poverty. Falling GDP is not only reflected in a lower GDP per capita, but also in rising poverty. A lower GDP also implies a reduction in total government revenues and therefore a reduction in governments' ability to afford social programs.

The Ethiopian economy is no exception in this respect. Several studies quantifying the impact of the COVID-19 pandemic on the Ethiopian economy have been already published including a comprehensive report by the United Nations (UN, 2020, henceforth). The macroeconomic analysis presented in that report relies on recent analyses by Ethiopia's Job Creation Commission (JCC, 2020, henceforth), the Ethiopian Planning and Development Commission (PDC, 2020, henceforth), and partially on the Ethiopian Economic Association (EEA, 2020, henceforth) and Cepheus (Cepheus, 2020, henceforth). Nevertheless, as Ethiopian Economic Association (2020) and Cepheus (2020) rely on inputs from JCC (2020) and PDC (2020) the results are necessarily interdependent and similar to each other.

In a nutshell, all these studies project a rather limited impact on GDP growth in their scenarios and none expect the GDP to actually drop. UN (2020) works with three scenarios ranging from a GDP growth between 7 and 4.2% in its optimistic scenario, 5.4% and 3.7% in a moderate scenario and 5% and 2.2% in a pessimistic worst-case scenario. In addition, the UN (2020) refers to UNECA for further work on the macroeconomic impacts concluding that GDP growth may be reduced by 1.2 pp, 2.4 pp, and 4.5pp in their best-, mid- and worst-case scenarios¹. Similarly, the IMF lowered its prediction for GDP growth from 6.2% in the January approved IMF Program to a current estimate of 3.2% for 2020 and from 7.0% to 3.7% for 2021. Almost the same GDP growth, i.e. 3.2% in 2020

¹ Results from UNECA analysis are reported in the form of downward deviations from a numerically unknown no COVID-19 scenario.

and 3.6% in 2021 is expected also by the World Bank.² Only the EEA (2020) discusses an alternative severe impact scenario assuming a partial lockdown of the rural agricultural sector for the duration of six months with the impact showing lower GDP growth by almost 10 pp.

PDC (2020) and JCC (2020) provide useful information about the country narratives such as expected employment layoffs by sectors and expected impact on GDP combining historical shares of directly affected sectors (hospitality, airline, textile or horticulture) on total GDP and expected length of closure being three or sixth months. The severe scenario then extends the closure to other sectors including agriculture in rural areas. Based on that, UN (2020) provides a narrative about the translation of macroeconomic numbers in poverty and other social and health indicators depending on the severity of the economic slowdown.

While this study can bring limited new insights and analysis of the Ethiopian labour market and actual and potential sector lockdowns, our aspiration is to provide consistent macroeconomic scenarios that can be used for the socio-economic analysis. The drawback of all the previously used approaches is a lack of general equilibrium and dynamic perspective. PDC (2020), JCC (2020) and the EEA (2020) on which the UN (2020) is built, all focus on the supply side of the economy. Our contribution lays in the extension of the analysis to the demand side of the economy, and through that, to medium- and long-term development. Furthermore, we add the relationship between the real economy, the external sector, the monetary sector, and last but not least, the fiscal accounts. All that in a dynamic framework.

We argue that the missing linkages between the economy's supply and demand sides – and from the demand side to the capital accumulation and the long-term growth – may not only lead to a significant underestimation of the actual impact, but also to an underestimation of its medium and long-term consequences. Conversely, all studies mentioned above implicitly assume that selected parts of the economy will switch-on easily after the lockdown period without a significant impact on the medium and long-term growth of the economy.

The “switch-off/on” style of the sectoral analysis is probably useful for the estimation of the ongoing drop and it is understandable that it is of primary interest now. Nevertheless, it is the recovery phase after the initial drop that is more important and here the switch-off/on-style of analysis may be misleading. How will the recovery look like and how much will the country potential be lost forever (if any) are the critical questions we aim to address.³ A few aspects are crucial in this respect.

First, investment decisions, both in physical and human capital, need to be taken on board as effects of falling investments today will show its result only in years to come. Therefore, it is important to analyse the behaviour of households and firms leading to decisions about consumption, savings and investments in physical as well as human capital. Although one can argue that the majority of Ethiopian households live a subsistence lifestyle and there are no saving/investment decisions to be made, this argument is not fully correct. A decision taken by a household about children either attending the school again once they reopen or dropping out and helping their parents in the fields is actually a decision about investment in human capital with a corresponding impact on future growth prospects. This is especially critical in developing

² See IMF Country Report No. 20/150 on Ethiopia (May 2020) and the latest WB Global Economic Prospects (June 2020). Links to both documents are provided in references.

³ Jordà, Singh and Taylor (2020) show that the negative impact of serious pandemics can last for up to 40 years with the peak around 20 years after the outbreak.

economies as it has been recognized that even relatively short breaks in education processes have significant negative consequences for the future.⁴

Second, similarly to PDC (2020), JCC (2020), EEA (2020) and Cepheus (2020) we decompose the production side in four critical economic sectors, i.e. agriculture, manufacturing, market services, and non-market services (government). Handling the sectors simultaneously and facing common supply of labour and capital (both physical and human) we are able to analyse potential spill overs among the sectors when facing declines in capital accumulation because of falling foreign direct investment (FDI) or deteriorating human capital (for instance). Depending on the specification of the production technology, each sector may react in a different way to a common shock. Naturally, even when using all available data and existing analysis we will not be certain whether we model the sectors properly. Nevertheless, the ability to create alternative scenarios of economic development depending on different sectoral specification will add value to the analysis.

Third, contrary to the analysis of PDC (2020), JCC (2020) and EEA (2020) we handle explicitly the expected developments in the world economy and in Ethiopia's main trading partners and analyse their impact on specific sectors depending on their exposure to foreign demand. There is evidence that some parts of the economy, such as hospitality, may be hit by both fading foreign demand as well as the domestic (partial) lockdown. The dual source of the shock should not be overlooked. In other words, assessing the drop in economic activity only from the domestic perspective can be misleading as the removal of the domestically imposed lockdown will not help if the foreign demand remains non-existent. In this respect it is important to understand and analyse the developments of the global economy. Recent phenomena, such as mass tourism, will probably take years rather than months to reach pre-COVID 19 levels (if ever).

⁴ Latest data on education published by the Ethiopian Ministry of Education (Education Statistics Annual Abstract 2011 E.C. (2018/19) shows worsening of school dropouts in recent years and closure of schools is probably cause further worsening of recent trends.

2 Definition of scenarios

We define three scenarios that, while related to those described in UN (2020), follow modified assumptions. The modification concerns the assumption about the spread of the COVID-19 infection within the population in Ethiopia and the explicit handling of the global economy. The UN (2020) scenarios are built on assumptions about different spread (speed and extent) of the COVID-19 infection, the subsequent government actions in terms of local lockdowns, and other disruptions caused by the breaking of supply chains of food, agricultural inputs, and other necessities. The scenarios discussed in UN (2020) assume that the actual spread of COVID-19 and associated economic lockdowns will vary from “up to 5,000 cases per month” through “10-15,000 cases per month” to “more than 30,000 cases per month” in the worst-case scenario as of April 2020. That is at odds with the reality of around 4,000 officially confirmed cases in total since the beginning of the global pandemic as of late June 2020. Nevertheless, the Ethiopian economy is being hit in a similar way to the rest of the world. Therefore, we do not link scenarios directly to the spread of the COVID-19 infection, but rather think about scenarios in direct relation to the global economy.

There is a high chance that the actual spread of the infection will not be properly measured given the capacity of the health services in the country. In addition, even if it was, it might not have direct medical implications in a way observed in advanced economies given the country’s predominantly young population. Even if the government had a detailed picture of the spread of the disease, it is still questionable whether it may (and has the capacity to) impose a systematic lockdown of the population in urban and especially rural areas. Recent evidence from India, Mexico, and Egypt shows that even governments in countries which actually experience an exponential rise in confirmed cases are easing (or planning to ease) the lockdown, simply because economically they cannot do otherwise. In this respect, we see the global economy as more critical for future GDP growth than the actual spread of COVID-19 in the country.

All scenarios incorporate the specific factor of the actual shutdown of the education sector (with its 3.4% share of GDP) – a factor that has been downplayed by PDC (2020), JCC (2020) and EEA (2020). It has been argued that as long as the employees get paid the impact on the overall GDP remains limited. This idea follows an accounting identity according to which the GDP calculated by the income method (salaries and operational surplus) equals GDP calculated by the production method. It is clear though that, despite the fact that teachers are being paid, the value added of the sector, i.e. the service of educating children, is not being created. While the immediate impact on GDP may not be visible from the perspective of national accounts, the medium and long-term growth prospects will be affected through the negative impact on the accumulation of human capital. This will inevitably lead to lower growth of total factor productivity and lower growth of the potential output in the future. Although the economic literature concerning economic growth is wide and varied, it shares a common feature emphasizing the importance of human capital, its creation, and dissemination for the growth of total factor productivity. Existing empirical evidence shows a clear link between the average years of schooling and the growth of total factor productivity. When describing scenarios in detail, we discuss the quantification of the impact that school closures can have on average years of schooling through school dropouts, as well eventual cuts in government expenditure on education and training.

In our baseline (optimistic) scenario we assume that the economies of main trading partners will start to recover beginning on Q3 2020. However, the recovery will only be gradual and GDP will return to pre-COVID-19 levels approximately in Q1 2021 (China), Q1 2022 (United States), Q4

2022 (Eurozone), and only at the end of 2023 (South Africa).⁵ While a certain portion of the potential output will be lost forever, the exact size varying among countries, we do not expect that the long-term economic growth of Ethiopia's main trading partners will be systematically negatively affected. In addition, we do not expect that the recovery of the main trading partners will be automatically and fully transmitted to affected sectors in Ethiopia. While the export-oriented parts of manufacturing and agriculture may recover together with the demand in trading partner countries, the recovery of tourism and related hospitality sector will face further delays. On the domestic side, we expect that (beyond the impact from the global economy) some parts of manufacturing and market services will experience an additional shock from the local lockdown, while selected activities of non-market services such as education are directly impacted.⁶ We do not expect the agriculture to be affected beyond the impact through exports, and the recently reported invasion of desert locust. Regarding the impact of school closures, we assume a decline in the value of average years of schooling by 10% in coming years, i.e. from an average of approximately 2.8 years to an average of 2.52 years.

In our pessimistic scenario we assume that the recovery in trading partner economies will be delayed by another six to twelve months in comparison to the baseline scenario, with imminent impact on domestic export and tourism related sectors. In addition, we follow UN (2020) and add small disruptions in the local agricultural sector driven by delays in supply of fertilizers which cause a decline in production. In line with the discussion above, we do not condition the pessimistic scenario on confirmed COVID-19 cases up to 15,000 per month. We see this scenario as reasonably probable without the need for officially confirmed COVID-19 cases and government-imposed lockdowns to actually happen. Missing foreign demand, no tourist arrivals, falling remittances and FDI are sufficient causes to generate the collapse of several sectors of the economy and significant spill over to the rest. Regarding the impact of school closures, we assume a 20% decline in average years of schooling in coming years as a consequence of longer periods of school closures and disruptions in subsistence farming resulting in higher school dropouts.

In both the baseline and pessimistic scenarios, we assume that the resulting gap in government financing will not trigger fiscal consolidation that would negatively impact social sectors, namely the education and health sectors. We report the rising fiscal deficit driven by lower revenues and announced containment measures with a size of 1.5% of GDP, but assume that the deficit will be covered either by increased grants or borrowing from the international community. In a nutshell, the government will be able to deal with the economic slowdown without the need to cut its expenditures and exacerbate the situation.

In contrary, in our worst-case scenario we take the pessimistic view as described above and add fiscal consolidation triggered by the mounting budget deficit. The fiscal consolidation totals 2.5% of GDP and is split among expenditures on general services (1% of GDP), economic services (0.5% of GDP), and education and training (1% of GDP). The latter is of primary interest for our analysis as it further negatively impacts average years of schooling, and through that, long-term growth and development objectives. We assume that average years of schooling decline by 30% in coming years.

It is important to note that in all three scenarios we assume that the IMF program approved in January 2020 remains binding and bars the government from monetary financing of the budget deficit. Should the government not respect the IMF program and finance the budget deficit through

⁵ Naturally, the speed of recovery can change with new information and updates available.

⁶ The argument that as long as teachers and other school staff receive their salaries the education sector should not be counted as affected is blurred in our view. The value added of this sector, i.e. education of children, is not being created and that has consequences to current and future GDP.

the National Bank above the agreed amount of 20 billion birr, a sharp depreciation of the currency, an inflationary spike and severe consequences for economic activity would be unavoidable. Facing declining revenues, the government can – leaving monetary financing aside – balance the budget only through raising grants and concessional borrowing from international organizations and bilateral donors, or through cuts in expenditures. Both options are discussed within the scenarios.

3 Simulation results

Scenarios presented below were simulated using an Ethiopia-specific version of the HERMIN type macroeconomic model. A brief description of the model is provided in Appendix I.

3.1 World economy and main trading partners

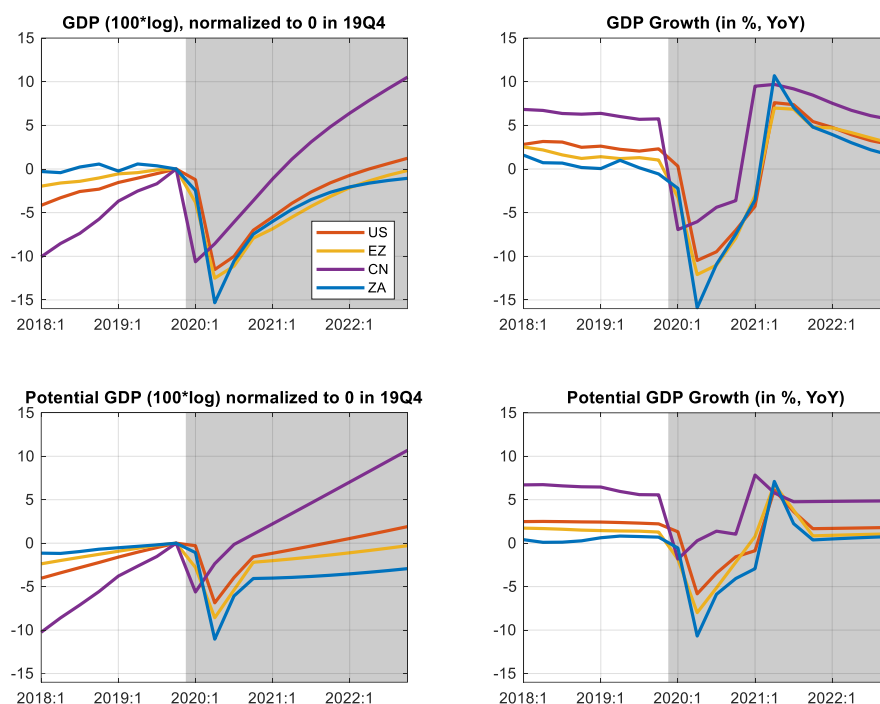
Assumptions of the world economy are taken from the World Economic Macroeconomic Model (WEMM), which is similar to the IMF Global Projection Model.⁷ The WEMM is operated as a 10 countries multi-country model, plus an 11th block of remaining countries that consist of additional 22 countries plus an endogenous block of the 7 most important commodities. Together, the WEMM covers 85% of global GDP. The countries that are modelled explicitly are the United States, the Eurozone, China, Japan, Russia, the United Kingdom, India, Brazil, Mexico and South Africa. For the purpose of our analysis we explicitly use forecasts for the United States, the Eurozone, China, and South Africa.⁸

In order to properly evaluate the transmission of the global recession to the Ethiopian economy, it is important to understand not only the expected drop in GDP in the first two quarters of 2020, but also its distribution in actual GDP (demand side) and potential output (supply side) resulting in the shape of the output gap. While the output gap measures the business cycle with its own spill over to the Ethiopian economy, the drop in potential output and slowdown of its growth have different and longer lasting implications. One has to understand how the impact on potential output is split in a shift in the level of the potential and eventual slowdown of the growth and to what extent is the initial drop in the potential level compensated by an upward shift later on. Figure 1 illustrates this for the four countries mentioned above. The figure shows the level of GDP (left upper graph), the growth of GDP (right upper graph), the level of potential output (left lower graph) and the growth of potential output (right lower graph). For better understanding, we normalize levels of both GDP and the estimate of potential GDP to zero in Q4 2019. This helps to visualize and compare the ongoing initial drop and the subsequent recovery phase in economies of main trading partners.

⁷ See Box in recent publication of IMF WEO Chapter I (<https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/World-Economic-Outlook-April-2020-The-Great-Lockdown-49306>).

⁸ More information about the WEMM can be provided upon the request.

Figure 1



Comparing expected trajectories for the level and growth of GDP and its potential makes it clear that medium to long-term impacts of the current crises differ substantially for the countries in question. While permanent loss of potential in the United States or China is expected to be rather small and both economies are expected to return to pre-COVID levels within 2020, the same will take approximately one year longer for the Eurozone and three years longer for South Africa. Multiple factors play a role here, ranging from households' consumption/savings decisions depending on uncertainty about the future, households' aging profile, firms' decisions about investment, and government response through expenditures and taxation, to name some. It is out of the scope of this analysis to discuss foreign economies in detail, but it is important to understand that the structure of the drop in trading partner countries matters for what will be happening in Ethiopia.

Table 1 summarizes expected GDP growth this year and in the next two years and its split into growth of potential and the output gap. These variables, together with expected foreign inflation and interest rates, feed the forecast for Ethiopia.

Table 1

Country	Variable	2020	2021	2022
United States	GDP growth (YoY %)	-6.4	4.0	3.8
	Potential (YoY %)	-2.3	2.6	1.8
	Output Gap (YoY %)	-3.8	-2.4	-0.5
Eurozone	GDP growth (YoY %)	-8.2	3.9	3.9
	Potential (YoY %)	-4.2	3.1	1.0
	Output Gap (YoY %)	-4.8	-3.9	-1.0
China	GDP growth (YoY %)	5.1	9.6	6.7
	Potential (YoY %)	0.2	5.9	5.0
	Output Gap (YoY %)	-5.3	-1.8	-0.2
South Africa	GDP growth (YoY %)	-8.6	4.8	2.7

Country	Variable	2020	2021	2022
	<i>Potential (YoY %)</i>	5.1	1.6	0.6
	<i>Output Gap (YoY %)</i>	4.7	1.7	0.4

3.2 Optimistic scenario

In the optimistic scenario, the global economy is the key factor behind the impact on the Ethiopian economy. This means that, the Ethiopian economy the economy will be hit by the drop of economic activity in foreign economies to the extent that it is exposed to the rest of the world through exports of agricultural and manufacturing products and services such as hospitality and airline transport. Therefore, as soon as the foreign economies start to recover to pre-COVID-19 GDP levels and beyond, so will the Ethiopian economy. We assume only limited additional disruptions caused by domestically imposed lockdowns that further impact the hospitality and –marginally– construction sectors.

Direct sensitivity of the Ethiopian economy to foreign economies remains rather limited. Exports account for only around 2.8% of GDP of which only 0.4 pp stays for combination of textile and flowers. Among the directly impacted sectors we count manufacturing with a share of GDP of 4.1%, and hotels and restaurants with the share of 2.6%. Tourism is not defined as one sector of the economy. Thus, missing tourist arrivals will be spread to hotels and restaurants, and various other sectors such as wholesale and retail trade, transport and communication, financial intermediation, and others. Overall, Ethiopia is a closed economy by international standards. As long as the key sectors of agriculture and construction remain unaffected the impact will be limited.

At the same time as Ethiopia faces an unprecedented drop in economic activity, developed countries face indirect effects that have the potential to seriously harm Ethiopia's future growth prospects, even in the most optimistic scenario. First, it is expected that there will be significant decline in remittances from all Ethiopians working and living abroad. That will have an impact on the well-being of many households and lead to a decline in their spending. Second, it is expected that FDI will decline this year and in coming years with a negative impact on investment activity, the future stock of capital, and the future growth of potential output. Both will lower aggregate demand (consumption and investment) and contribute to the actual drop in GDP first, while impacting medium and long-term growth prospects later on. Finally, it is expected that the closure of schools will lead to an increase in school dropout rates, with a negative impact on average years of schooling, and through that, on the growth of total factor productivity and potential output. We assume that school drop-outs will cause a 10% decline in average years of schooling and that this will cause a decline in the growth of potential output by 0.15 pp (Benhabib and Spiegel, 2005).

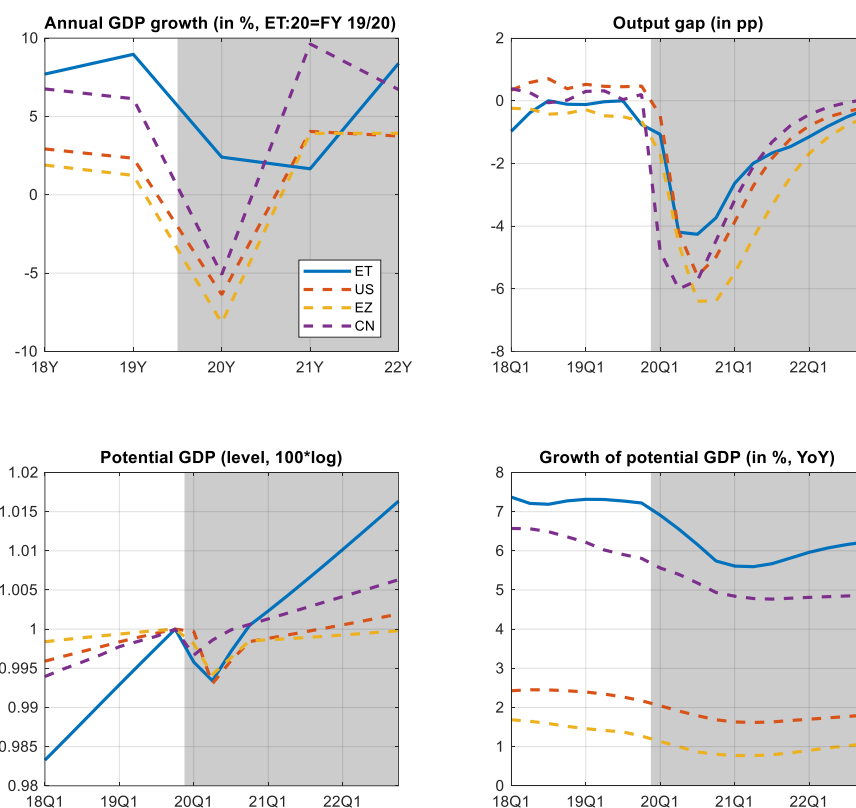
On the monetary side we expect that the IMF Program approved in January will be implemented, which leaves only limited room for manoeuvre to the National Bank of Ethiopia (NBE) with respect to financing of the government budget. Inflation should therefore stay under control in the medium-term despite short-term inflationary shocks. At the same time, we expect faster depreciation of the currency than Cepheus (2020), because the NBE is obliged to minimize the discrepancy between the official and shadow exchange rates under the IMF Program. Faster average depreciation is consistent with the average inflation being brought towards 10%, as envisaged within the IMF Program.

Considering all the factors mentioned above, the economy is expected to grow by 2.4% and 1.7% in FY 2019/20 and FY 2020/21 respectively and return to the growth of 8.4% in FY 2021/22. The slowing GDP growth is only one part of the story though, the one that we observe on the surface.

An important element is also the division of the GDP slowdown in the demand side represented by the actual GDP and the supply side measured by the potential GDP. A similarly important element is the pace of recovery, i.e. the future growth of potential GDP. In this respect, our analysis shows that around 60% of the slowdown is linked to a drop in potential output and the rest represents the negative demand position, i.e. a negative output gap. This is shown in Figure 2 where the upper left chart plots the output gap (difference between actual and potential output), the upper right chart plots levels of potential output, the lower right chart plots growth of potential output and the lower right chart plots the annual growth of GDP. Splitting the actual GDP in output gap and potential output is a useful analytical concept that allows us to think in terms of short-term impact and medium to long-term consequences.

Since our scenarios are defined primarily with respect to the global economy, and the US, the Eurozone and China in particular, Figure 2 shows not only the expected trajectories for Ethiopia (blue solid line), but also for the main trading partners. For the sake of comparison, the levels of potential output are normalized to 1 in the fourth quarter of 2019.

Figure 2



It is clear that, while Ethiopia is hit by the global recession, the drop in GDP growth is far shallower in comparison to its main trading partners and that its potential output recovers faster (similar to China) and continues growing at a higher rate. That is clearly the consequence of the relatively limited openness of the Ethiopian economy. Nevertheless, the drop in economic activity worldwide is significant enough to lower GDP growth in Ethiopia to below 2% in FY 2020/21.

Table 2 decomposes the GDP growth outlook under the baseline scenario for fiscal years 2019/20 and 2020/21. The services sector will experience the largest slowdown due to domestic restrictions (such as border closures, restrictions to the movement of people, trade disruption, transport bans, restaurant closures, among others) and the global demand slump, which will cut the activity of Ethiopian Airlines and lead to lower tourism income. Manufacturing, dominated by the garment

industry, and construction are expected to slow as the pandemic puts a significant number of jobs at risk. Some studies expect that 40%-60% of jobs in the labour-intensive manufacturing sector may be lost. Contrary to that, we expect that the agriculture sector will not experience a large disruption, as a substantial share of production of the agriculture sector is meant for self-consumption and is performed by small land-owners. Additionally, the pandemic has hit the economy during the lean season, when the fields are being prepared for this year's harvest. The slowdown of global demand will mainly affect the horticulture and coffee industries.

Table 2

Sector	Share on GDP (in %)	2019/20	2020/21
Agriculture	32.9	3	2.3
Manufacturing and Construction	27.7	4.5	2.8
Services	39.4	0.5	0.4
Total	100	2.4	1.7

Table 3 summarizes the forecast for GDP growth, inflation, and the nominal exchange rate. The expected decline in inflation from the recently observed elevated numbers is based on the objective imposed by the IMF program, which restricts the National Bank from excessive easing of monetary policy and monetary financing of the budget deficit. The “black market” nominal exchange rate depreciates following the depreciation of the equilibrium real exchange rate, the elevated risk premium, and the positive inflation differential against the main trading partners. At the same time, we expect the official exchange rate to depreciate towards the level of the “black market” exchange rate, in line with the conditions of the IMF program. The trajectories of inflation, and the nominal exchange rate, are important inputs for the calculation of government revenues, expenditures, budget deficit, and debt.

Table 2

Medium term projection	2019/20	2020/21	2021/22
GDP growth (in %)	2.4	1.7	8.4
Inflation (in %)	19.9	16.5	11.4
ETB per USD	31.7	40.3	46.2

All numbers are expressed for FY.

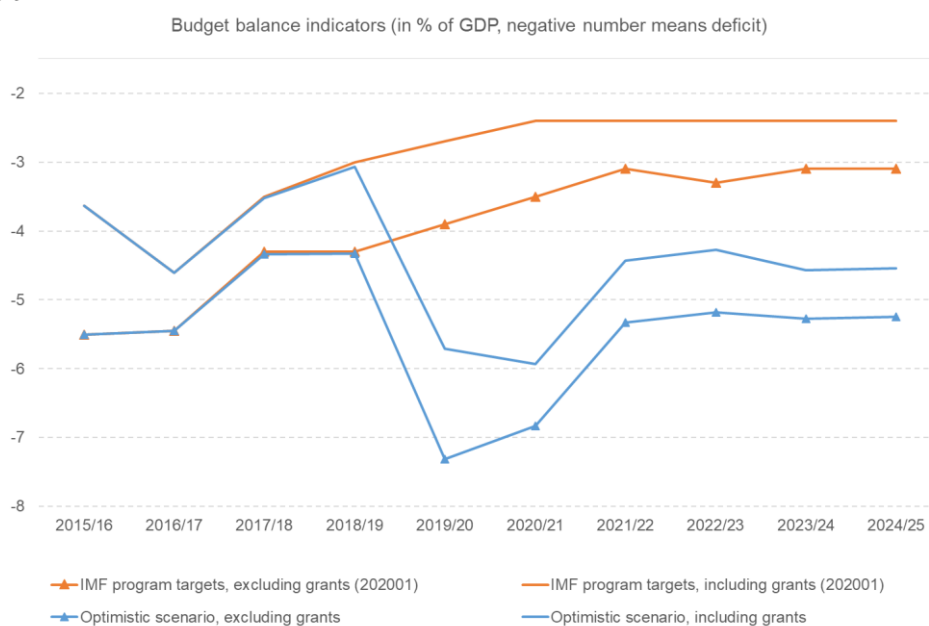
Naturally, the slowing economy has a negative impact on government revenues, while the government announced additional expenditures amounting to 1.5% of nominal GDP. Table 4 and Figure 3 show a level of budget deficit consistent with the baseline scenario and compares it with the latest IMF forecast (May 2020) and the IMF Program approved in January 2020.

Table 4

Optimistic Scenario (Percent of nominal GDP)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/24
Government Revenues	12.2	11.7	11.2	11.7	12.0	12.1	12.2	12.2
Grants	0.8	1.8	1.6	0.9	0.9	0.9	0.7	0.7
Government Expenditures	16.1	15.5	18.0	18.0	16.8	16.8	17.0	17.0
Fiscal Balance (excl. grants)	-3.8	-3.8	-6.8	-6.3	-4.8	-4.7	-4.8	-4.7
Fiscal Balance (incl. grants)	-3.0	-2.6	-5.2	-5.4	-3.9	-3.8	-4.1	-4.0
IMF forecast (May 2020)								
Fiscal Balance (excl. grants)			-5.6	-4.5	-2.8	-2.8	-2.6	
Fiscal Balance (incl. grants)			-4	-3.5	-1.9	-1.9	-1.9	
IMF Program targets (Jan 2020)								
Fiscal Balance (excl. grants)	-3.8	-3.8	-3.4	-3.0	-2.6	-2.8	-2.6	-2.6
Fiscal Balance (incl. grants)	-3.0	-2.5	-2.2	-1.9	-1.9	-1.9	-1.9	-1.9

Excluding grants, the budget deficit deepens to 6.8% of GDP in FY 2019/20, 6.3% of GDP in FY 2020/21 and stays elevated to 4.7% of GDP in following three fiscal years. The difference with the latest IMF forecast – 1.2 pp in FY 2019/20, -1.8 pp in FY 2020/21 and approximately -2 pp later on— is caused by lower GDP growth expected in the short- as well as long-term in our scenario in comparison to the IMF forecast.

Figure 3



The reported budget deficit must rather be understood as an implied financing gap caused by the slowing economy and the active response of the government. It is probable that a deficit of this magnitude will not actually happen, unless financed predominantly through new loans from development partners. A more probable scenario would include a combination of additional grants and additional loans. That means the actual deficit including grants will be lower. In any case, an important feature of the baseline scenario is that the government is not forced to consolidate its expenditures facing the falling revenues.

The main risks to the baseline scenario are associated with the highly uncertain impact of the pandemic on the global economy – especially its recovery phase – and with the government’s inability to finance the mounting budget deficit triggering consolidation on the expenditure side. For now, the baseline world economy scenario still assumes that the current fall in GDP will be short-lived with a relatively mild negative impact in the long-term, especially in the US and China. However, the uncertainty about the length and depth of the COVID-19-driven recession is exceptionally high and published outlooks are gradually lengthening the recovery phase. Longer-lasting restrictive measures would result in slower long-term economic growth and lead to some restructuring of the affected economies.⁹ Both the pessimistic and worst-case scenarios aim to address this uncertainty.

3.3 Pessimistic scenario

The pessimistic scenario lengthens the recovery of Ethiopia’s main trading partners with an imminent impact on Ethiopian economy. We assume that China’s recovery will be slower and its potential GDP will return back to pre-COVID levels only in 2021, while the potential output of the US and the Eurozone will recover only at the end of 2023. This results in lower GDP growth in main trading partners by around 0.5 pp in comparison to the baseline. Nevertheless, even in the pessimistic scenario we do not expect the long-term growth of main trading partners to be

⁹ As suggested in Barro, Ursúa and Weng (2020) and Jordà, Singh and Taylor (2020) the period after global pandemics can be characterized by lower global equilibrium real interest rates driven by oversupply of savings over investments and raising real wages, which would trigger substitution between labor and capital. While growing real wages in developed countries would suggest reallocation of labor intensive production to countries with relatively cheap labor force, the overall low investment activity may globally reduce FDIs.

significantly affected, i.e. we do not expect that the average economic growth will be between zero and one, for instance, in the next ten years. In that sense our pessimistic scenario may still be rather optimistic.

The output gap in Ethiopia is expected to follow a similar path of demand slump as in global economies and will take 3-4 years to recover from the current demand slack. Ethiopia's potential output is expected to rebound in mid of 2021 following the Chinese recovery, but economic growth is going to be adversely affected by a slow recovery in US and the Eurozone.

A deeper drop in GDP growth and a longer recovery of the Ethiopian economy will have a stronger negative impact on school dropouts and consequently average years of schooling, which in turn would affect long-term growth. In comparison to the baseline scenario we expect that higher school dropouts will lead to 20% decline in average years of schooling causing the future long-term growth to slow down by approximately 0.3 pp.

Figure 4 and Table 5 present the pessimistic scenario. While GDP growth in FY 2019/20 is very similar to the baseline scenario, the main difference occurs in FY 2020/21 when GDP actually declines by -1.5% and recovers only to the growth of 6.3% in FY 2021/22. It is evident from Figure 3 that it is mainly the slow recovery in US and the Eurozone that impacts adversely the Ethiopian economy. Regarding the nominal side of the economy, we keep our assumption that the IMF program remains binding for the government. Hence, the National Bank acts in line with the program objective of keeping inflation around 10% and bringing the exchange rate towards the "black market" value. A deeper and more persistent slowdown of the Ethiopian economy leads to slightly lower inflation in the following years.

Figure 4

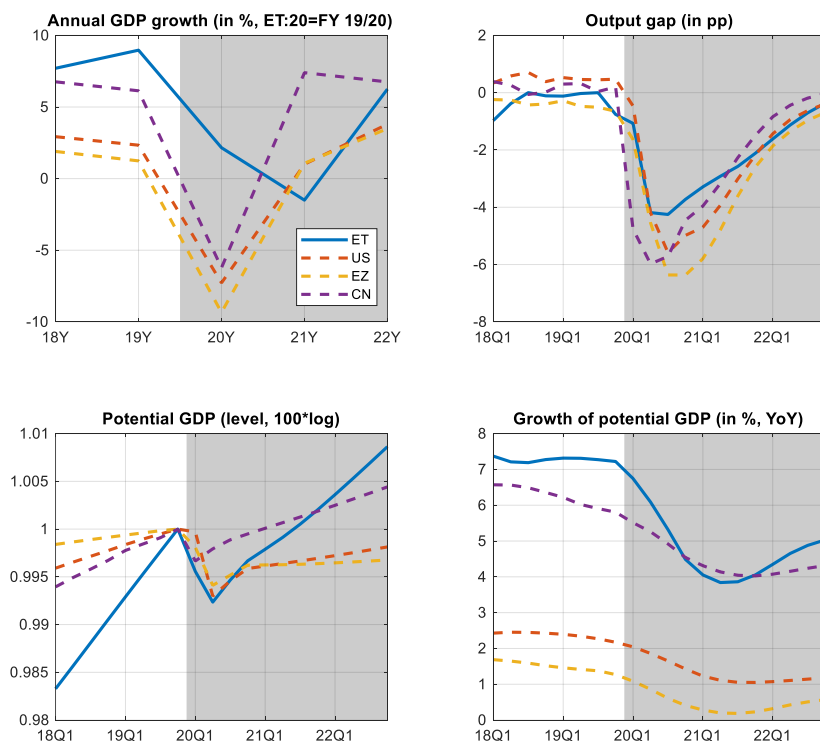


Table 5

Medium term projection	2019/20	2020/21	2021/22
GDP growth (in %)	2.2	-1.5	6.3
Inflation (in %)	19.9	16.4	10.1
ETB per USD	31.7	40.3	46.1

All numbers are expressed for FY.

Table 6 decomposes the GDP growth outlook under the pessimistic scenario for fiscal years 2019/20 and 2020/21. The services sector will experience a much larger contraction (decline of 4.5% in FY 2020/21) due to larger global demand slump and slower global recovery, which will cut the activity of Ethiopian Airlines, lower tourism income, and significantly lower the inflow of remittances. The manufacturing and construction sectors are expected to decline by 2%, reflecting lower demand for Ethiopian goods (garment) and lower investment in the country. We still expect that the agriculture sector will not experience large disruption as the slowdown of global demand will mainly affect the horticulture and coffee industries.

Table 6

Sector	Share on GDP (in %)	2019/20	2020/21
Agriculture	32.9	3	2.5
Manufacturing and Construction	27.7	4.2	-2.0
Services	39.4	0.0	-4.5
Total	100	2.2	-1.5

The nominal exchange rate hovers around similar values as in the baseline scenario, which is caused by no change in our view on the position of the equilibrium real exchange and the country risk premium. The global nature of the economic meltdown driven by COVID-19 pandemic does not provide any reason why a particular country that is not a commodity exporter should experience depreciation of its equilibrium real exchange rate or increase in its country risk premium against its main trading partners.

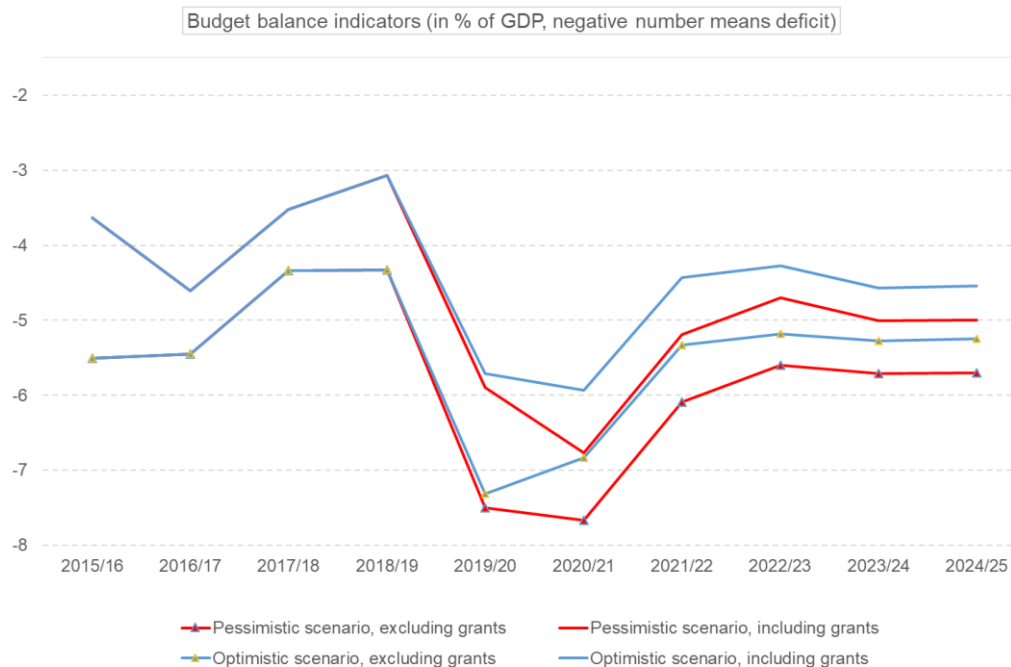
Naturally, the deeper slowdown of the economic activity further worsens the budget balance (Table 7 and Figure 5), although given the already low level of government revenues the sensitivity becomes weak. On the side of expenditures, we do not expect any further actions to support the economy (above automatic stabilizers) in comparison to the baseline.

Table 7

Pessimistic Scenario (Percent of nominal GDP)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/24
Government Revenues	12.2	11.7	11.2	11.7	12.0	12.1	12.2	12.2
Grants	0.8	1.8	1.6	0.9	0.9	0.9	0.7	0.7
Government Expenditures	16.1	15.5	18.2	18.9	17.5	17.2	17.4	17.4
Fiscal Balance (excl. grants)	-3.8	-3.8	-7.0	-7.2	-5.6	-5.1	-5.2	-5.2
Fiscal Balance (incl. grants)	-3.0	-2.6	-5.4	-6.3	-4.7	-4.2	-4.5	-4.5

Table 5 shows that the budget deficit reaches approximately 7% of nominal GDP in FY 2019/20, 7.2% of nominal GDP in FY 2020/21 and stays below 5% of nominal GDP in following years. Similar to the baseline scenario, we assume that the budget deficit will be covered by a combination of new grants and new loans from development partners and the government will not be forced to consolidate its expenditures. Imposed fiscal consolidation is the subject of the worst-case scenario.

Figure 5



3.4 Worst-case scenario

The worst-case scenario combines the pessimistic scenario with a forced fiscal consolidation on the expenditure side. The size of the consolidation is 2.5% of nominal GDP, leading to a lowering of the budget deficit below 5% of nominal GDP in FY 2020/21, i.e. close to the IMF prediction from May 2020. The consolidation is distributed among expenditures on general services (1% of GDP), expenditures on economic services (0.5% of GDP), and expenditures on education and training (1% of GDP). The latter is of primary interest for our analysis as it further negatively impacts average years of schooling, and through that, long-term growth and development objectives. We assume that average years of schooling decline by 30% in coming years causing a decline in long-term growth by 0.5 pp. The rest of the fiscal consolidation is assumed to impact the economy primarily through aggregate demand.

The worst-case scenario is presented in comparison to both the baseline and pessimistic scenarios in Figure 6 and summarized in Table 6. The main impact through aggregate demand takes place in FY 2020/21 when GDP growth declines by 2.7% and returns to a growth of 5.5% in FY 2021/22. The growth of potential GDP decelerates further through 2021 and only slowly returns to a growth of approximately 6% several years later. There is a permanent loss in the growth of the potential as it does not return to the pre-COVID-19 growth of between 7% and 8%. Naturally, this is based on the assumption that the government does not take any active action to revert the increase in school dropouts and decline in average years of schooling any time soon. Should the government implement new measures to lower school dropouts and increase average years of schooling, the worst-case scenario would not materialize.

Figure 6

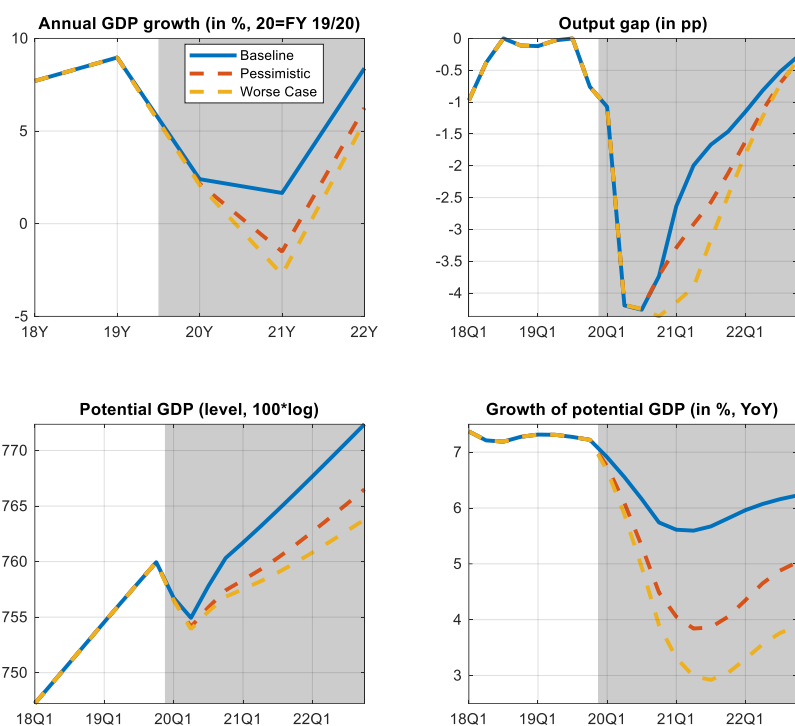


Table 3

Medium term projection	2019/20	2020/21	2021/22
GDP growth (in %)	2.1	-2.7	5.5
Inflation (in %)	19.9	16.1	9.3
ETB per USD	31.7	40.3	46

All numbers are expressed for FY.

Despite the worsened economic outlook, we still assume that the IMF program remains binding for the government and the National Bank acts in line with the program objective of keeping inflation around 10% and bringing the exchange rate towards the “black market” value. A deeper and more persistent slowdown of the Ethiopian economy leads to slightly lower inflation in the coming years and a slightly more appreciated nominal exchange rate (given lower inflation differential). Again, we do not change our view on the position of the equilibrium real exchange and the country risk premium.

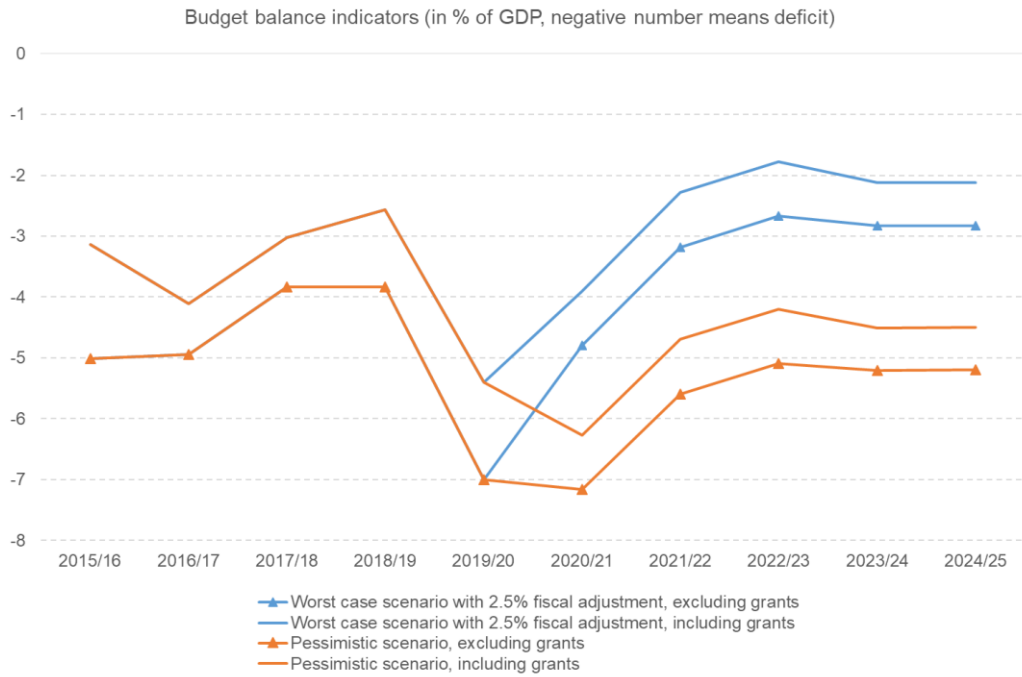
Table 8 and Figure 7 add more details about fiscal accounts and the fiscal balance. While the economy undergoes deeper recession in comparison to the pessimistic scenario, fiscal balance is thanks to the fiscal consolidation kept under 5% in FY 2020/21. Naturally, the latter represents a trade-off between fiscal sustainability and economic growth.

Table 8

Worst Case Scenario (Percent of nominal GDP)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Government Revenues	12.2	11.7	11.2	11.7	12.0	12.1	12.2	12.2
Grants	0.8	1.3	1.6	0.9	0.9	0.9	0.7	0.7

Worst Case Scenario (Percent of nominal GDP)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Government Expenditures	16.1	15.5	18.2	16.5	15.1	14.8	15.0	15.1
Fiscal Balance (excl. grants)	-3.8	-3.8	-7.0	-4.8	-3.2	-2.7	-2.8	-2.8
Fiscal Balance (incl. grants)	-3.0	-2.6	-5.4	-3.9	-2.3	-1.8	-2.1	-2.1

Figure 7



4 Conclusion and policy recommendations

The severity of the global recession driven by the COVID-19 pandemic will cause a significant slowdown of the Ethiopian economy in upcoming years. It is almost certain that GDP growth will be below 3% in FY 2019/20, and the probability of growth that is close to zero or even negative in FY 2020/21 is high. Even if the key sectors of agriculture and construction remain relatively unaffected, and the immediate damage seems controlled, there are still medium to long-term effects that may prove more serious than previously thought.

The slowing economy will negatively impact government revenues, which together with approved measures on the expenditure side, will drive the budget deficit (excluding grants) to the range of 6-7% of nominal GDP in FY 2019/20 and FY 2020/21. Budget deficits of this size are difficult, if not impossible, to finance by issuing new domestic government debt. In order to lower the deficit (including grants) to the number expected by the latest IMF forecast (and IMF program), the government needs to secure additional grants or concessional loans of approximately 1.5% of nominal GDP in FY 2019/20 and 2-3% of nominal GDP in FY 2020/21 (3% and 3-4% in the case of the IMF program). Otherwise, it may be forced to consolidate its expenditures by approximately same amount.

Fiscal consolidation would have additional consequences for medium to long-term development, especially if it impacted expenditures on education and training. Schools have been closed since March with potentially significant impact on school dropout, future level of average years of schooling, and Ethiopia's economic development. Any cut on expenditures in this area will exacerbate the problem.

The message for the government is clear. The situation is far more serious than envisaged in the analysis published earlier, including the IMF forecast update. The closure of the education sectors must be taken seriously, and properly included in the analysis. As a result of slowing economic activity, the financing gap in the government budget will be wider than expected. The government should put maximum effort in securing additional grants and concessional borrowing to avoid consolidation on the expenditure side of the budget. Finally, should the consolidation become inevitable, the government should restrain from reduction of expenditures on education and training.

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Appendix I The HERMIN macroeconomic model

The HERMIN macroeconomic model is suitable candidate for analysis of COVID-19 global pandemic on developing and frontier economies. Its advantages are: i) full national accounts (expenditure, income, and sector production), ii) all major tax and government expenditure categories, iii) simple Keynesian and neoclassical economics, iv) simple calibration and estimation, v) annual frequency, vi) implementation in Graphical User Interface not requiring any previous software knowledge.

The models have been constructed to explicitly handle the reality of developing and converging economies. They have been successfully used in the analysis of convergence of several peripheral countries of EU (Ireland, Spain, Portugal and Greece, Bradley *et al.*, 1995b) and was also employed in investigation of impacts of the CSF structural funds (Bradley *et al.*, 1995a) and the effects of Single Market (Barry *et al.*, 1997). They have been used to study the effects of the EU accession process in Central and Eastern Europe (Kejak and Vavra, 1999b) and mainly (from the Ethiopian perspective) the economic transformation from a command to market economy (Barry *et al.*, 2003).

HERMIN is a four sector supply side macroeconomic model which preserves enough room for the conventional Keynesian effects to work. The four sectors are Manufacturing, Market Services, Agriculture and Government with the two latter as largely exogenous or driven by a simple time trend. It is based in the neo-classical theory in that the investment and labour decisions of firms in the two main sectors (Manufacturing and Market Services) follow cost minimisation of CES production functions. The direct incorporation of income-output-expenditure identities permits both demand and supply side experiments.

The structure of the model can be depicted in three main blocks. First, the supply side with all the four sectors and labour supply dynamics. Second, the aggregate demand and absorption, and third, the income identities. Within this framework the most important of the behavioural equations are schematically illustrated in the Table 1.

Basically, there are three requirements which our model should satisfy:

1. The model must be disaggregated into a small number of crucial sectors which allow at least to identify and treat the key sectoral shifts in the economy over the years of transition.
2. The model must specify the mechanisms through which the transition economy is interconnected to the outside world. The external world economy is a very important direct and indirect factor influencing the economic growth and convergence of the transition economy, through trade of goods and services, inflation transmission, population emigration and inward foreign direct investment.
3. The modelling framework must recognize that a possible conflict may exist between actual situation in the country, as captured in HERMIN model with the use of historical data, and the desired situation towards which the transition country is evolving in the world of the single market. There is also a very important phenomenon of the changing degree of integration of the transition country into the structures of the EU which must be taken into account during the modelling process.

Thus, the HERMIN model framework focuses on key structural features of the transition economies with respect to such issues as:

1. Economic openness, exposure to world trade, and response to external and internal shocks;
2. Relative sizes and features of the traded and non-traded sectors and their development, production technology and structural change;
3. Wage and price determination mechanisms;
4. Functioning and flexibility of labour markets with the possible role of international labour migration;
5. Role of the public sector and public debt, and the interactions between the public and private sector trade-offs in public policies.

The structure of the model can be best thought as being composed of three main blocks: a supply-side, an absorption side and an income distribution side. Obviously, the model functions as integrated systems of equations, with interrelationships between all their subcomponents. However, for expositional purposes we describe the HERMIN modelling framework in terms of the above three subcomponents, which are schematically illustrated in Table 3.1.

Conventional Keynesian mechanisms are at the core of the HERMIN model. Thus, the absorption and income distribution subcomponents (shown in Table 3.1) generate the standard income-expenditure mechanisms of the model. However, the model also has neoclassical features, mainly associated with the supply subcomponent (illustrated in Table 3.1). Thus, output in manufacturing is not simply driven by demand. It is also influenced by price and cost competitiveness, where firms seek out minimum cost locations for production (Bradley and Fitz Gerald, 1988). In addition, factor demands in manufacturing and market services are derived using a CES production function, where the capital/labour ratio is sensitive to relative factor prices. The incorporation of a structural Phillips curve mechanism in the wage bargaining mechanism introduces further relative price effects.

We illustrate the schematic structure of the HERMIN model in Table 3.1 and now comment briefly on some key aspects.

The supply side

Output determination. As we already discussed in Section 3.1, the output determination in the sector of traded goods (Manufacturing) is modelled in an integrated schema of output and factor demands, as in (Bradley and Fitz Gerald, 1988), where output depends both on final demand and international competitiveness.

Table 4 The HERMIN Schematic

Supply Aspects
<i>Manufacturing Sector (Sector of Tradable Goods)</i>
$Output = f_1(\text{World Demand, Domestic Demand, Competitiveness, } t)$
$Employment = f_2(\text{Output, Relative Factor Price Ratio, } t)$
$Investment = f_3(\text{Output, Relative Factor Price Ratio, } t)$
$Capital Stock = Investment + (1-\delta) \text{ Capital Stock}_{t-1}$
$Output Price = f_4(\text{World Price} * \text{Exchange Rate, Unit Labour Costs})$
$Wage Rate = f_5(\text{Output Price, Tax Wedge, Unemployment, Productivity})$

Supply Aspects
<i>Competitiveness = National/World Output Prices</i>
<i>Market Service Sector (Sector of Non-Tradable Goods)</i>
<i>Output = $f_7(\text{Domestic Demand, World Demand})$</i>
<i>Employment = $f_8(\text{Output, Relative Factor Price Ratio, } t)$</i>
<i>Investment = $f_9(\text{Output, Relative Factor Price Ratio, } t)$</i>
<i>Capital Stock = Investment + (1-δ)Capital Stock_{t-1}</i>
<i>Output Price = Mark-Up On Unit Labour Costs</i>
<i>Wage Inflation = Manufacturing Sector Wage Inflation</i>
<i>Demographics and Labour Supply</i>
<i>Population Growth = $f_{11}(\text{Natural Growth})$</i>
<i>Labour Force = $f_{12}(\text{Population, Labour Force Participation Rate})$</i>
<i>Unemployment = Labour Force – Total Employment</i>
Demand (Absorption) Aspects
<i>Consumption = $f_{13}(\text{Personal Disposable Income})$</i>
<i>Domestic Demand = Private and Public Consumption + Investment)</i>
<i>Net Trade Surplus = Total Output - Domestic Demand</i>
Income Distribution
<i>Income = Total Output</i>
<i>Personal Disposable Income = Income + Transfers - Direct Taxes</i>
<i>Current Account = Net Trade Surplus + Net Factor Income From Abroad</i>
<i>Public Sector Borrowing = Public Expenditure - Tax Rate * Tax Base</i>
<i>Public Sector Debt = (1 + Interest Rate) Debt_{t-1} + Public Sector Borrowing</i>
Key Exogenous Variables
<i>External: World output and prices; exchange rates; interest rates;</i>
<i>Domestic: Public expenditure; tax rates.</i>

Since the Cobb-Douglas production function is too restrictive, we use the CES form of the added value production function and impose it on both manufacturing (T) and market service (N) sectors:

$$Q = A \left[\delta \{ \exp(\lambda_L t) L \}^{-\rho} + (1 - \delta) \{ \exp(\lambda_K t) K \}^{-\rho} \right]^{\frac{1}{\rho}}$$

In this equation, Q, L and K are added value, employment and the capital stock, respectively, A is a scale parameter, ρ is related to the constant elasticity of substitution, δ is a factor intensity parameter, and λ_L, λ_K are the rates of technical progress embodied in labour and capital respectively.

In both the manufacturing and market service sectors, factor demands are derived on the basis of cost minimisation subject to given output, yielding a joint factor demand equation system of the form:

$$K = g_1 \left(Q, \frac{r}{w} \right)$$

$$L = g_2 \left(Q, \frac{r}{w} \right)$$

Here, w and r are the cost of labour and capital, respectively. The above simple scheme, using a putty-putty model of the capital stock (i.e., malleable *ex ante* and *ex post*), proved difficult to estimate in practice. This is not surprising in light of the derived nature of the capital stock data.

Hence, a switch was made to a marginal, or putty-clay, system where investment, the new vintage of capital stock, is driven by output and relative factor prices, and the capital stock is assumed to be malleable *ex ante* but not *ex post*. In the absence of data on vintage output and labour inputs, the corresponding marginal output and employment are crudely proxied by the total levels of these variables. Alternatively, we can focus on the long-term formulation of the equation, when the ratio of capital to output is proportional to the ratio of investment to output.

$$\frac{I}{Q} = (\delta + g) \frac{K}{Q}$$

where g is the growth in output and δ is the depreciation rate. Hence, the modified joint factor demand system can be written in the form:

$$I = h_1 \left(Q, \frac{r}{w} \right)$$

$$L = h_2 \left(Q, \frac{r}{w} \right)$$

where the capital stock is now generated by a perpetual inventory formula,

$$K_t = I_t + (1 - \delta)K_{t-1}.$$

Although the central factor demand systems in the T and N sectors are functionally identical, they will have different estimated parameter values and two further crucial differences. First, capacity output in the traded sector is driven by world demand and domestic demand, and is influenced by international competitiveness. In the non-traded sector, on the other hand, actual output is driven purely by weighted final demand. This captures the essential difference between neoclassical-like tradable sector and the sheltered Keynesian non-traded sector.

Second, the output price in the T sector is partially externally determined by the world price. In the N sector, the producer price is a pure mark-up on costs. Thus again, this puts a difference between the partially price taking tradable sector and the price making non-tradable sector.

Wages: The behaviour of the manufacturing sector tends to be dominant in relation to wage determination. Wage rates are modelled as the outcome of a bargaining process that takes place between well-organized trades unions and employers, with the frequent intervention of the government. Formalized theory of wage bargaining points to four paramount explanatory variables (Layard, Nickell and Jackman , 1990):

Output prices: The price that the producer can obtain for output clearly influences the price at which factor inputs, particularly labour, can be purchased profitably.

The tax wedge: This wedge is driven by total taxation between the wage denominated in output prices and the take home consumption wage actually enjoyed by workers. The wedge effect arises because workers try to bargain in terms of a take home wage denominated in consumer prices and not in terms of gross pre-tax wages denominated in producer prices.

The rate of unemployment: The unemployment or Phillips curve effect basically states that the more people who are unemployed in an economy, the lower will be the subsequent wage demands from

those still with job and who seek jobs. In this formulation, for trades unions unemployment is inversely related to bargaining power. The converse applies to employers.

Labour productivity: The productivity effect comes from workers' efforts to maintain their share of added value, i.e. they want at least to enjoy some of the gains from higher output per worker.

The Absorption

Private consumption. As in developed countries private consumption represents by far the largest component of aggregate demand in TEs. The properties of an analytical expression of consumption behaviour are a key to the effects of fiscal policy on aggregate demand. According to our theoretical background briefly reviewed in the previous section, in the standard version of HERMIN the determination of household consumption is quite simple and orthodox in the sense of Keynes as private consumption is related to real personal disposable income^{10,11}.

In this model we do not model manufactured exports and imports explicitly. Instead, the net trade surplus is residually determined from GDP on an output basis less private and public consumption, private and public investment and stock changes.

The public sector

With a view to subsequent policy analysis, HERMIN includes a moderate degree of institutional detail in the public sector along conventional lines. Within total public expenditure we distinguish public consumption (mainly wages of public sector employees), transfers (social welfare, subsidies, debt interest payments), and capital expenditure (public housing, infrastructure, investment grants to industry). Within public sector debt interest, we distinguish interest payments to domestic residents from interest payments to foreigners, the latter representing a leakage out of GDP through the balance of payments.

If we leave tax rates unchanged in simulated public expenditure increases, the stock of outstanding government bonds could rise without bound relative to GNP, as increased interest payments on new debt compound with previous debt. Hence, it would become difficult to evaluate the wider effects of different expenditure shocks if the final debt positions were very different.

Obviously, one needs a method of altering public policy within the model in reaction to the economic consequences of given policy shock. If all the policy instruments are exogenous, this is not possible, although instruments can be changed on the basis of off-model calculations. A solution of the issue of 'intertemporal fiscal closure rule' has been suggested in (Bryant and Zhang, 1994). We include a closure or policy feed back rule into HERMIN, whose task is to ensure that the direct tax rate is manipulated in such a way as to keep the debt/GNP ratio close to an exogenous notional target debt/GNP ratio. The policy feed back rule presently used in the Irish HERMIN model is based on the IMF world model, MULTIMOD (Masson et al, 1989), and takes the following form:

¹⁰ We may see some parallels between the way the household behavior in developing countries and TEs differs from that of developed ones: a lot of idiosyncratic as well as aggregate uncertainties may talk for more pronounced precautionary saving motive in those countries than in developed ones; underdeveloped financial and banking system causes the incidence of liquidity constraints should be much higher and due to the more traditional family life, at least in least developed TEs, the household may provide a closer approximation to the dynastic household of Barro (1974).

¹¹ In the HERMIN model of Ireland, its authors experimented with a hybrid liquidity constrained and permanent income models of consumption. They found that the properties of the model were relatively invariant to the choice between a hybrid and a pure liquidity constrained function. Of course, if a forward looking model of wage income were used, the properties of the model would change radically (Bradley and Whelan, 1997).

$$\Delta GTYPR = \alpha \left\{ \frac{(GNDT - GNDT^*)}{GNPV} \right\} - \beta \left\{ \frac{(GNDT - GNDT^*) - (GNDT_{-1} - GNDT_{-1}^*)}{GNPV} \right\}$$

Here, GTYPR is the (fractional) direct tax rate, GNDT is the total national debt, GNDT* is the target value of GNDT, GNPV is nominal GNP, and the values of the parameters¹² α and β are selected in the light of model simulations.

There is effectively no monetary sector in HERMIN, so both the exchange rate and domestic interest rates are treated as exogenous¹³. Thus, the nominal 'anchor' in each model is the world price in foreign currency. Furthermore, the financing of public sector borrowing is handled in a rudimentary fashion and public debt is simply the accumulated stock of the net flow of annual borrowing.

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¹² The performance of the rule can be quite sensitive to the choice of the numerical values of α , β .

¹³ This feature of the HERMIN model is the subject of further model improvements in future.