POLICY RESEARCH WORKING PAPER　9679

Gender Dimensions of COVID-19 Economic Impact in Chad

Insights from a CGE Model and Household Phone Survey

Kayenat Kabir
Hasan Dudu
Fulbert Tchana Tchana

WORLD BANK GROUP

Macroeconomics, Trade and Investment Global Practice
May 2021

Abstract

This paper uses computable general equilibrium model-based simulations to assess the gender dimensions of the impact of COVID-19 on economic outcomes, that is, labor force participation, employment, wages, and earnings. It leverages the 2020 High-Frequency Phone Survey in Chad to assess the impact of COVID-19 on female-headed households, which comprise 23 percent of the country's households. The findings show that the COVID-19 pandemic will have a disproportionately higher negative impact on women in urban areas. The simulation results suggest that more women than men working in paid jobs might lose their jobs. Although the paper focuses on the impact of COVID-19 in 2020, the findings can be generalized as the hysteresis effects might be deeper and more prolonged if the pandemic is more prolonged. The situation is potentially dire, especially in service sectors, where most women are employed in urban areas. Moreover, the High-Frequency Phone Survey shows that COVID-19 has notably impacted the households' income from enterprises and suggests that this negative impact is more prevalent for female-headed households. Although male- and female-headed households are using common coping strategies during the pandemic, female-headed households in rural and urban areas have been more reliant on aid from family and friends and less reliant on savings, credit, or the sale of assets.

Gender Dimensions of COVID-19 Economic Impact in Chad: Insights from a CGE Model and Household Phone Survey[1]

Kayenat Kabir,[2] Hasan Dudu,[3] and Fulbert Tchana Tchana[4]

---

1. Introduction

Globally, the negative socioeconomic impacts of COVID-19 are expected to affect women more than men. For example, on average, the share of women is larger in the informal sector (ILO 2020), and given that the pandemic affected the informal sector more, the female working population is more likely to be economically affected. Beyond economic impacts, COVID-19 can disproportionately affect women's health, education, and voice and agency through different channels, including increased unpaid care work, reallocation of health care resources, and increased gender-based violence during lockdown (UN Women 2020). On the other hand, worldwide male COVID-19 patients are more likely to be directly affected by the virus, needing more intensive treatment or succumbing to mortality (Peckham et al. 2020).

While the gender-differentiated transmission channels and impacts of COVID-19 are widely recognized, and there is new, sprawling evidence on the gendered impact of COVID-19, few studies quantitatively assess the possible or actual economic impacts on women through labor distribution channels and less so for women in fragile and conflict-prone countries. This paper aims to assess the possible and actual economic impacts of COVID-19 on women and female-headed households in Chad using Computable General Equilibrium (CGE) model-based simulations and evidence from a household phone survey conducted during the pandemic.

Chad has a large informal economy and ranks 147 of 153 countries in the global gender gap index. The first cases of COVID-19 in Chad were reported in March 2020, and since then, as of March 2021, fewer than 5,000 cases of COVID-19 have been reported. There was also a compound health risk with the outbreak of malaria and chikungunya in 2020. The risks of the virus spreading remain high with the advent of new variants. Even though COVID-19 cases may not seem to be high in landlocked Chad (and neighboring countries), the measures necessitated to mitigate the spread of the disease, including the closure of land borders and the main airport, within-country movement restrictions, individual's behavioral changes in fear of contracting the disease, and links to a global economy which is severely affected by the COVID-19 crisis pose adverse socioeconomic consequences in Chad as also evidenced from the July 2020 Chad COVID-19 High-Frequency Phone Survey (Chad HFPS 2020).

We use CGE model-based simulations with inputs from household living standards survey data conducted in 2018/19 (ECOSIT 4) and follow Djiofack et al. (2020) to simulate the possible sectoral and distributional effects of the COVID-19 pandemic on Chad's economy and analyze the economic and labor market impacts on women. We focus on female labor force participation outcomes in the three main sectors: agriculture, manufacturing, and services; and production in female-owned agricultural farms. Next, we use the first round of the Chad HFPS 2020 to assess actual income and employment impacts on female-headed households and the coping strategies adopted by these households. The HFPS is a household-level survey with limited information on individuals. Thus, we are unable to assess the impact on women in general through this survey. It is important to note here that women in female-headed households cannot be assumed to have the same outcomes as women in male-headed households, nor are they directly comparable with male-headed households in terms of structure. Nevertheless, female-headed households comprise about 23 percent of Chad's households and have distinct characteristics that render them vulnerable to shocks.

In what proceeds, we first describe the methodology related to the CGE simulations and the use of phone survey in section 2, followed in section 3 by a discussion of our findings in three sub-sections: i) gendered impacts in labor markets based on our CGE simulation results, ii) impacts on female-headed households

based on results from the phone survey, and iii) impact channels that we were not able to assess quantitatively such as gender-based violence (GBV), health and education but that deserve consideration. Section 4 concludes the paper with a summary of the main findings.

2. Methodology

2.1. CGE Simulation

The model used for the CGE analysis is the "Mitigation, Adaptation, and New Technologies Applied General Equilibrium" (MANAGE) model (van der Mensbrugghe, 2020). MANAGE is a recursive dynamic, single-country CGE model based on neoclassical theories of the firm and household behavior, assuming firms are profit maximizers and households are utility maximizers. In the context of COVID-19, where individuals across all income levels and sectors of the economy are affected simultaneously, CGE model-based simulations are well-suited for a comprehensive evaluation of ex-ante impact, capturing direct and indirect effects through a wide variety of transmission channels along several dimensions. One caveat of using CGE models for gender-based analysis is that these models use a social accounting matrix (SAM) as data input. However, most SAMs (like the one used in this study) do not account for unpaid domestic work and care labor in the economy, which is largely provided by women, due to lack of data as they are not covered by the system of national accounts and by most household surveys.

The 2017 Chad SAM[5] that we use to calibrate the CGE model is updated from the 2016 SAM using the 2017 Supply and Use Table (SUT), the Government Financial Operations Table (TOFE), and the 2010 Table of Integrated Economic Accounts (TCEI).[6] Furthermore, to better keep track of distributional and labor market impacts by gender dimensions, the household and labor accounts in the SAM are disaggregated using the Harmonized Household Living Standards Survey 2018/2019 (ECOSIT 4),[7] which was conducted by the National Institute of Statistics, Economic and Demographic Studies (INSEED).

The updated 2017 Chad SAM includes 33 sectors, and the agricultural sectors (food crops, cash crops, livestock, fishing, and forestry) are further split by gender of farm/enterprise owners to represent the different cost structures of female and male-owned farms. Labor accounts for each of these sectors are disaggregated into eight categories by three dimensions: gender, salary and non-salaried payment, and farm and non-farm work. Households are disaggregated by rural and urban deciles.

The version of the model used for this study is based on Burns et al. (2020), which incorporates several developments, among which the most relevant for this study is the demographics module. The standard version of the MANAGE model tracks population in three age cohorts: 0-14, 15-64, and 65+. The new module tracks population at each age between 0 and 100 (people 100+ are assumed to be in age group 100). In every period of the model solution, people in each age move to the next age by taking into account the death rate at each age. Then, in every period, newborns join age 0 based on the birth rates for that period. Age,period-specific death rates, and the period-specific birth rates are calibrated to the UN population projections such that the model generates the same projections over time. The labor supply at time t is then the sum of all ages between age 15 and 64 multiplied by the labor force participation rate. The total labor force is then distributed across different labor types based on base

---

[5] The SAM is available upon request.

[6] The SUT, TOFE, TCEI and the household survey were sourced from INSEED. The latest available TCEI is for 2010.

[7] In French the original title of the survey is Enquête sur la Consommation des Ménages et le Secteur Informel au Tchad (Ecosit 4). It is a survey with a sample size of 7,493 households representative at the national and regional levels and by urban/rural.

year shares. The population is also linked to the household population based on the base year shares. Lastly, following the demographic dividend literature, saving rates are linked to the young and old dependency ratios as it is now possible to calculate those from the model output.

We follow Djiofack et al. (2020) to simulate the possible effects of the COVID-19 pandemic on Chad's economy to analyze economic impacts considering gender dimensions. In this approach, the main impact of a pandemic is assumed to be the behavioral changes caused by the fear of exposure to disease and restrictions imposed by the government to mitigate the disease's spread. The direct effects of an infection (e.g., death toll, suffering due to sick days, etc.) are inarguably important but are unlikely to have significant macroeconomic implications (World Bank, 2020).

Like Djiofack et al. (2020), we assume that avoidance of market interaction during the pandemic would affect the economy through the following domestic channels:

- *Decreasing labor supply:* People who can afford it avoid the labor markets by not working or working less.
- *Decreasing labor productivity:* The limitations on mobility and access to labor and other markets would inevitably cause a reduction in labor productivity. Also, the pandemic would affect health care services which might result in diagnosis and treatment of other diseases and increase sick days further.
- *The decline in capital productivity:* As labor productivity declines, capital productivity would also fall due to increased idle time for machinery and other fixed capital assets. Further, the uncertainty and disruptions due to the pandemic would cause a reduction in the maintenance of such capital, which would eventually be reflected in capital productivity.
- *The slowdown in transport and tourism sectors:* The measures taken by the government to slow down the spread of disease (e.g., lockdown in urban areas) would cause a significant loss in economic activity in some sectors such as tourism, restaurants, and transport sectors.

We also introduced to the simulations some global effects of the pandemic:

- *Increase in trade and transport margins:* The measures taken by governments and firms to prevent the spread of the disease, such as stricter phytosanitary regulations or hygiene standards, would increase transaction costs and would be reflected in higher trade and transport margins in imports and exports.
- *Decreased flow of foreign exchange(F/X):* Uncertainty due to the pandemic would cause investors to postpone or cancel their investment, causing a reduction in F/X flows to the country. Further, most foreign direct investment projects rely on the expertise of foreigners who would not travel to the country due to the pandemic, which would disrupt such projects.
- *Plummeting commodity prices*: The price of oil and minerals has plummeted during the pandemic due to weakening demand and supply chain problems. This might have important implications for the balance of payments of countries that rely on those commodities for government revenue and F/X flows.

Following World Bank (2019) and Djiofack et al. (2020), we use the change in the above variables during the 2014-2016 Ebola crisis in Sierra Leone (worst affected country) with the average change for these variables over 2005-2014 as a proxy for the macroeconomic impact of COVID-19. We control for the effects of commodity price crises during the same period by comparing the changes in the rest of the West

African countries in the same way and making necessary adjustments to account for the commodity price crises. Lastly, we also adjust the estimated impacts for Sierra Leone according to the Epidemic Preparedness index of Chad and Sierra Leone.

Table 1: Estimated impact of the COVID-19 pandemic on main impact channels

Impact channel	Shock Size (%)
Labor supply	-2.2
Labor productivity	-6.2
Capital productivity	-2.1
Trade and transport margins	2.7
F/x flows	-33.2
Commodity prices	
Oil	-30.0
Minerals	-10.0
Tourism	-25.0

Source: Authors' calculation following Djiofack et al. (2020)

The model is set up for a short-run analysis by eliminating various substitution possibilities in production. The standard set of model parameters allows various production factors to be substituted with each other and adjust the export supply based only on the difference between domestic and international prices. In the version used for this paper, such substitutions are either not possible or very limited. These changes reflect the possible disruptions and difficulties many sectors are likely to face while adjusting to the pandemic conditions. In this short-term setting:

- Substitution between capital and skilled labor is not possible.
- Substitution between capital vintages (i.e., new and old capital) is not possible.
- Substitution between land, labor, and capital is not possible at the top production nest.
- Substitution of export and domestic supply is significantly reduced.

2.2. Econometric estimation using data from Chad's household surveys

We leverage data from the Chad High-Frequency Phone Survey (HFPS)[8] conducted in May-June 2020 by INSEED (with support from the World Bank) to assess the actual impact on female-headed households in Chad. The main objective is to identify the type of households directly or indirectly affected by the pandemic and identify its main impact channels. The survey is a 30-minute Computer Assisted Telephone Interview (CATI) conducted at the household level and contains limited information at the individual level. As such, we are unable to assess the gendered impact on women in general through the survey. Since we know the gender of the household head, we can assess the impact on female-headed households.

The Chad HFPS 2020 sample was drawn from ECOSIT 4 (conducted in 2018-2019), which is the same survey that we used to engender the Chad SAM. The final survey sample consists of 1,748 households

---

[8] Accessible at https://microdata.worldbank.org/index.php/catalog/3792.

representative at the national level and residence areas: Ndjamena (capital city), rural areas, and other urban areas. So far, one round of the survey has been published.

We first present a few employment and income-related characteristics of female-headed households in Chad, making these households uniquely vulnerable to shocks. For this purpose, we use data from the full sample of ECOSIT 4. Next, to make inferences about COVID-19's economic impacts, we concentrate on the four modules in the HFPS related to employment and revenue, loss of income, shocks and coping strategy, and COVID-19 impact. We use simple descriptive statistics and test of proportions (prtest) to identify the most affected income channels and coping strategies adopted by female-headed households and use probit model regressions to identify outcomes significantly different from male-headed households. We use weights associated with households in the survey so that the reported results are representative at the national level. The weights also correct for any selection bias associated with not interviewing households that do not own mobile phones or that cannot be reached despite repeated call attempts.

The probit model, which is well-suited to model dichotomous or binary outcome variables, allows us to determine if differences in binary outcomes between female and male-headed households observed through descriptive statistics and proportion tests are significant. It allows us to methodically document trends and impact instead of relying on anecdotes and assumptions. However, our method and survey data do not tell us about the underlying mechanisms, i.e., why there are differences. We draw inferences from the existing literature to explain possible reasons for these differences.

The main binary outcome that we examine through the probit regression is the reduction in household income from various sources in the past 12 months and the adoption of different coping strategies. For household income reduction, we constructed binary variables for the decline in household income from any source (value one if "yes" and zero if unchanged or increased) and for each income source: wage employment, non-farm enterprise income, farm income, remittance. The households are asked if they experienced a reduction in income during the time of the survey. Reporting loss of income from a given source is conditional on receiving income from that source prior to the COVID-19 pandemic. As it is a short survey, most variables are categorical or binary, and we cannot make quantitative inferences about the income loss amount.

Unlike Josephson et al. (2020), which uses a univariate reduced form regression to assess socioeconomic dimensions of COVID-19 impact, we use a probit regression with the gender of the household head, rural-urban location, education level of household head, and household size as independent variables. The assumption of exogeneity is difficult to maintain for the gender of household head (hhgender), and there could be omitted variable bias. A possible way to check for omitted variable bias is to examine if the significance and sign of the coefficient of interest changes with variation in independent variables. We first run the probit regressions with only the gender of the household head as an independent variable and add the other independent variables one by one in separate regressions. The significance of the coefficients of our variable of interest remains the same.

3. Results

3.1. Labor market impacts of COVID-19

Chad has a predominantly informal economy where 92 percent of the labor force work as family farm workers, wage laborers in other farms, or non-salaried off-farm workers. The agriculture sector is the primary employer for both men (70 percent), and women (60 percent), where women work primarily as labor in their family farms (66 percent of the total female agricultural labor force) and men work mostly as own-account workers and as labor in other farms. It is critical to note that formal employment among women in Chad's mostly informal economy is much lower than among men—only 8.6 percent receive wages from an employer, and women are 9 percent less likely than men to be in formal employment. Even in the manufacturing sector, where the proportion of female employment is slightly higher than male employment, 98 percent of the women work as non-salaried workers.

Women constitute 45.8 percent of Chad's working population. The female labor force participation rate[9] is 49 percent, which is 13 percentage points lower than the Sub-Saharan Africa regional average and 24 percentage points lower than the male labor force participation rate of 73 percent.

Table 2: Distribution of male and female labor across main sectors (percent share of workers in total employed in primary and secondary employment)

	Agriculture	Manufacturing	Services
Female	32.7	5.2	8.6
Salaried Non-farm	0.0	0.1	1.2
Non-Salaried Non-farm	0.0	5.1	7.4
Family Farm	21.5	0.0	0.0
Other Farm	11.2	0.0	0.0
Male	35.0	3.6	15.0
Salaried Non-farm	0.0	1.1	5.9
Non-Salaried Non-farm	0.0	2.4	9.0
Family Farm	12.7	0.0	0.0
Other Farm	22.3	0.0	0.0
% of the total female labor force	70.3	11.2	18.5
% of the total male labor force	65.3	6.7	28.0

Source: Authors' calculations using Harmonized Household Living Standards Survey 2018/19/ECOSIT 4

The impact of the COVID-19 pandemic on labor markets is potentially disastrous. Results from the phone survey suggest that less than three months into the pandemic, 20 percent of the respondents who were employed before the outbreak stopped working due to potentially COVID-19 related reasons, and 6 percent could not work because of business or office closure, which could also partially be due to COVID-19. More than nine out of ten employed respondents did not receive payment during the outbreak period.

The CGE simulation results suggest that wage rates would decline by about 60 percent on average, with a 50 to 60 percent decline for women and a 45 to 65 percent decline for men (Figure 1 and Table 3). Female labor force participation reduces by more than 3 percent in 2020 due to the pandemic and bounces back

---

[9] Labor force participation rate (LFP) is defined as the percentage of the female population ages 16+ that is working or actively looking for employment.
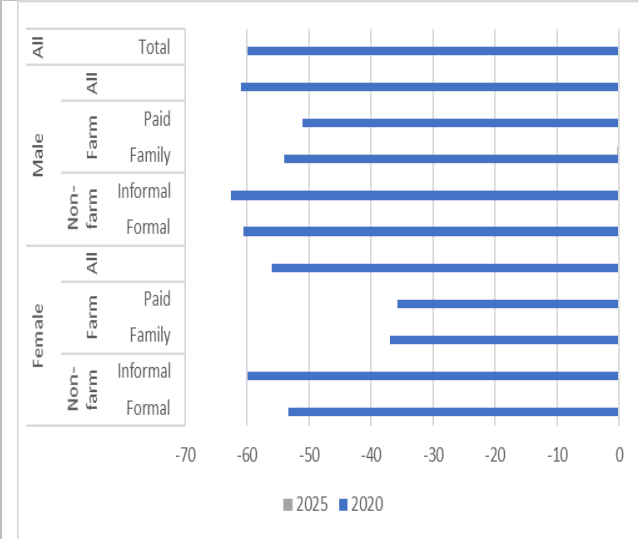
to baseline levels in 2021 (Figure 2). However, this conclusion relies on the assumption that the pandemic would be under control by the end of 2020 and would not cause harm beyond. The hysteresis effects might be deeper and more prolonged if the pandemic is more drawn out. These simulated gendered impacts occur in the backdrop of a potential reduction in GDP growth by 9 percent from the BaU level of 4.5 percent, causing Chad's economy to shrink by 4.5 percent (see the Appendix for macroeconomic impacts).

Table 3: Percentage change in wages from BaU level due to COVID-19 impacts						
Wage	2020	2021	2022	2023	2024	2025
Female	-56.07	0.46	0.08	0.03	-0.01	-0.04
Male	-60.94	-1.49	-0.76	-0.35	-0.17	-0.10
Source: CGE model simulation results						

Figure 1: Percentage change in wage rates from BaU level due to COVID-19 impacts, by male and female labor categories	Figure 2: Percentage change in female labor force participation rate, BaU level and COVID-19 impacts
Source: CGE model simulation results	
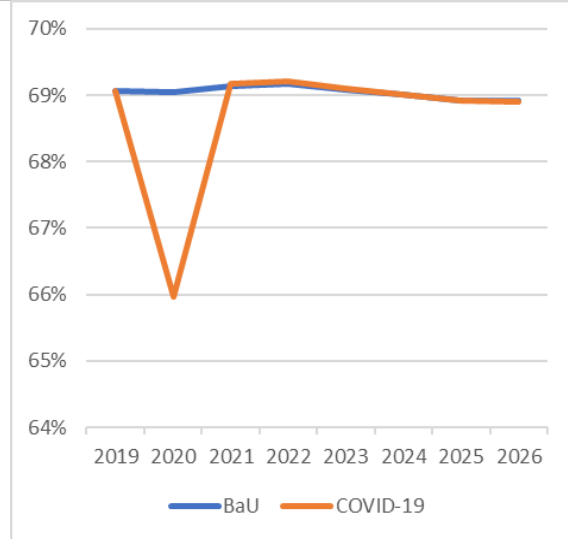
The declines in FLFP, wages, and earnings are not uniform across different female labor types. It is imperative to first understand the changes in the sectoral production pattern in the economy due to COVID-19 to understand the differential sectoral impacts in FLFP and wages in our CGE simulation results. The economy shifts towards agricultural production (Table 4) as a result of skyrocketing exports,[10] which is not sustained in the long run. The manufacturing sector suffers the most (around 13 percent decline) for the longer term, followed by the service sector (3 percent decline). Notably, the increase in agricultural production is due to an unsustainable increase in exports and does not imply increased supply (i.e.,

---

[10] Agricultural exports increase to balance the current account deficit under increasing pressure on foreign exchange flows. The main sources of disruption to foreign exchange flows are plummeting commodity exports and declining foreign savings. This creates a "reverse Dutch" disease for Chad, where the most crucial sector of the economy can expand.

imports and domestic production) of food commodities in the domestic market. On the contrary, the total supply of agricultural products declines by 7.85 percent, having severe implications for food security.

Table 4: Sectoral impacts of COVID-19 (percent change from baseline)						
Production	2020	2021	2022	2023	2024	2025
Agriculture	1.61	0.99	0.47	0.20	0.05	0.00
Manufacturing	-13.22	-1.53	-0.65	-0.31	-0.14	-0.08
Oil	-28.79	-5.08	-1.91	-0.83	-0.32	-0.16
Services	-3.22	-0.28	-0.24	-0.12	-0.08	-0.06
Exports						
Agriculture	25.84	5.51	2.42	1.09	0.36	0.11
Manufacturing	-34.96	-5.92	-2.18	-0.94	-0.36	-0.18
Oil	-35.32	-6.01	-2.21	-0.96	-0.37	-0.18
Services	18.63	-2.58	-0.96	-0.43	-0.21	-0.13
Imports						
Agriculture	-75.55	-0.78	-0.14	-0.16	-0.14	-0.14
Manufacturing	-16.60	-0.70	-0.38	-0.16	-0.09	-0.06
Services	-32.52	-3.69	-0.86	-0.39	-0.17	-0.10
Total Supply (Production + import)						
Agriculture	-7.85	0.10	0.08	0.01	-0.02	-0.03
Manufacturing	-9.86	-0.18	-0.18	-0.10	-0.06	-0.05
Services	-8.46	-0.76	-0.32	-0.16	-0.09	-0.06

Source: CGE model simulation results

Within the agricultural sector, simulation results suggest that cash crop production is expected to drop for a longer term while food crop and livestock production increase due to COVID-19 impacts. On the one hand, the driving force behind this asymmetrical impact between food and cash crops is the slowing economic activity in urban areas (e.g., productivity losses and declining export demand), which results in a significant decline in the intermediate demand for the cash crops. On the other hand, food crop and livestock production increase in response to plummeting imports.

Female-owned livestock, fishing, and forestry activity expand by almost 13 percent during the crises, resulting in an increase in the total production of livestock, fishing, and forestry activity and the total production of female-owned agricultural activities. In other words, female-owned agriculture shifts to livestock production as their capital productivity is affected less by COVID-19 impacts. This may allow female farmers to expand production since they are less affected by the higher input prices and shortage of capital.

However, the higher labor intensity in female-owned food crop production leads to a decline in their food crop production, while aggregate food crop production increases driven primarily by male-owned farms. Female-owned food crop farms are more labor-intensive and less capital-intensive than male-owned crop farms. According to the phone survey data, 4.7 percent of rural households reported an increase in the price of farming inputs, and 3.7 percent reported lack of labor as the shock that has most negatively impacted them during the pandemic.

The finding that female-owned livestock, fishing, and forestry activities could expand should be taken with the caveat that the model assumes that women can expand their farms as long as market conditions allow them to do so. Considering the agency of women in Chad, this might be challenging for most women. During the 2014-16 West Africa Ebola outbreak, which restricted movement, women's agricultural productivity was affected, resulting in women defaulting to less negotiable village loans, which further impacted their long-term economic prospects (Korkoyah and Wreh, 2015).

Table 5: Percentage change in production from BaU level in female and male-owned agricultural farms due to COVID-19 impacts						
Production	2020	2021	2022	2023	2024	2025
Agriculture	1.6	1.0	0.5	0.2	0.1	0.0
Male Owned	0.6	0.3	0.0	-0.1	-0.1	0.0
Female Owned	3.6	2.3	1.4	0.7	0.3	0.0
Food Crops	0.5	0.4	0.2	0.1	0.1	0.0
Male Owned	2.3	0.7	0.4	0.2	0.1	0.1
Female Owned	-3.6	-0.3	-0.2	-0.1	0.0	0.0
Cash Crops	-25.4	-4.5	-2.9	-1.8	-1.1	-0.6
Male Owned	-23.0	-4.5	-2.9	-1.9	-1.2	-0.8
Female Owned	-30.4	-4.5	-2.8	-1.7	-0.9	-0.2
Livestock, Fish, Forestry	5.1	2.2	1.1	0.4	0.1	0.0
Male Owned	0.3	0.3	-0.3	-0.3	-0.3	0.0
Female Owned	13.6	5.6	3.4	1.7	0.8	0.1
Source: CGE model simulation results						

The drop in labor force participation level (i.e., the level difference in FLFP from baseline) is highest among farmworkers as most women are employed in this category (Figure 3). A disproportionate reduction in FLFP (in percentage from baseline) occurs among salaried and informal non-farm (i.e., services and manufacturing) female labor (Figure 4). Inevitably, more women will lose their jobs compared to men, notably in service sectors, where most women are employed in urban areas. Preliminary evidence from a World Bank Enterprise Survey (ES) in Chad demonstrates that the proportion of women as a fraction of all permanent full-time workers decreased by 6.6 percent, driven by a steep change in medium-sized enterprises. The follow-up COVID-19 Enterprise Survey was conducted during June and July 2020 to interview respondents of 377 firms which were initially surveyed between January and May 2019 as part of the standard ES.

Figure 3: Level change (in million) in female employment from BaU in 2020	Figure 4: Change (%) in female employment from BaU in 2020
Source: CGE model simulation results	Source: CGE model simulation results
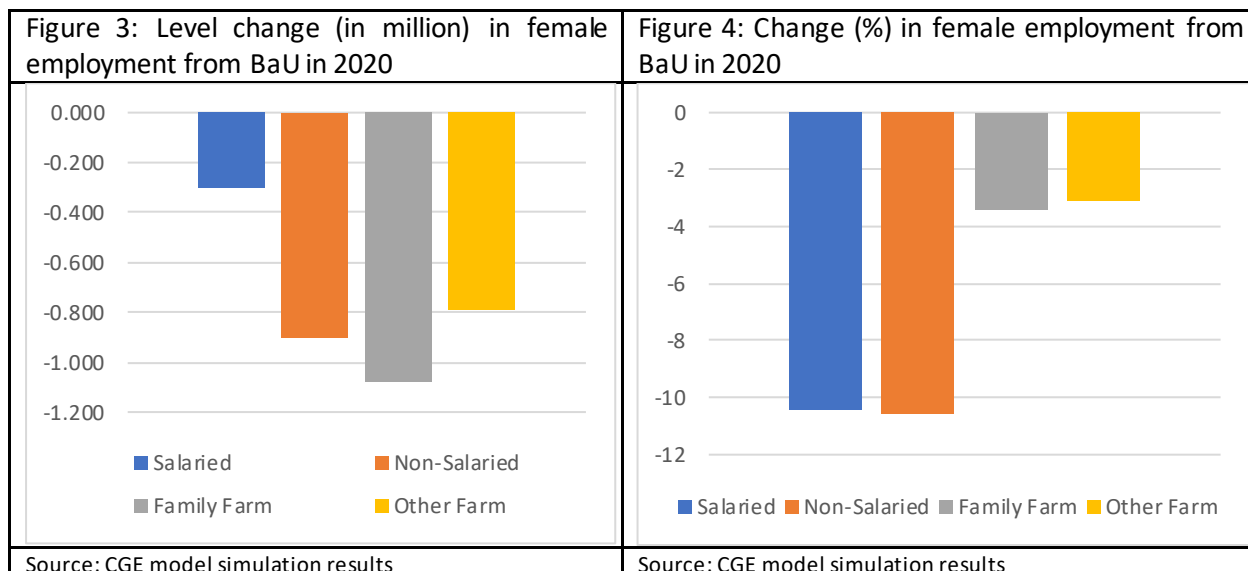
Total employment falls by more than 6 percent. Consequently, households' labor income declines by 63 percent on average, with urban households are hit harder. The decline in labor income is due to the plummeting wage rates driven by the limitations on the substitution possibilities in production, the fall in overall price levels, and productivity losses due to COVID. Approximately 7 percent of the decline is due to labor productivity loss, while the decline in overall price levels contributes to 33 percent of the reduction. Around 10 percent is caused by production losses. The remaining 13 percent is due to restrictions on adjustments in input and factor mix, which causes a 6 percent decline in employment to have a much higher impact on wages.

The expansion in female-owned farm production compensates for losses in the income of rural households. The decline in earnings of women in urban areas is slightly less than men during the crisis, but note they continue to stay behind the BaU levels until 2025 and possibly beyond. The underlying driver is the sharp decline in the sectors where women are employed more. The recovery of the capital and labor use to BaU levels is slow after a significant reallocation of resources in the economy towards more male-dominated sectors. In the absence of recovery measures, the new allocation of resources across sectors distorts gender gaps further and keeps employment and wage rates of women below the BaU. The smaller decline is not surprising given the already existing gaps in the earnings, but the more prolonged impact on wages implies widening pay gaps. Female labor in rural areas is affected less, thanks to increased agricultural activity. Note that wages for unpaid family labor are part of the farm income that is not paid to someone outside the home to do the work that is done by family members. Thus, a smaller decline in unpaid family labor wages implies a more modest reduction in agricultural income.

Figure 5: Labor Income by household type, % difference from baseline	Figure 6: Main source of income reported by households (% of households)
	Source: Author's calculations from HFPS 2020
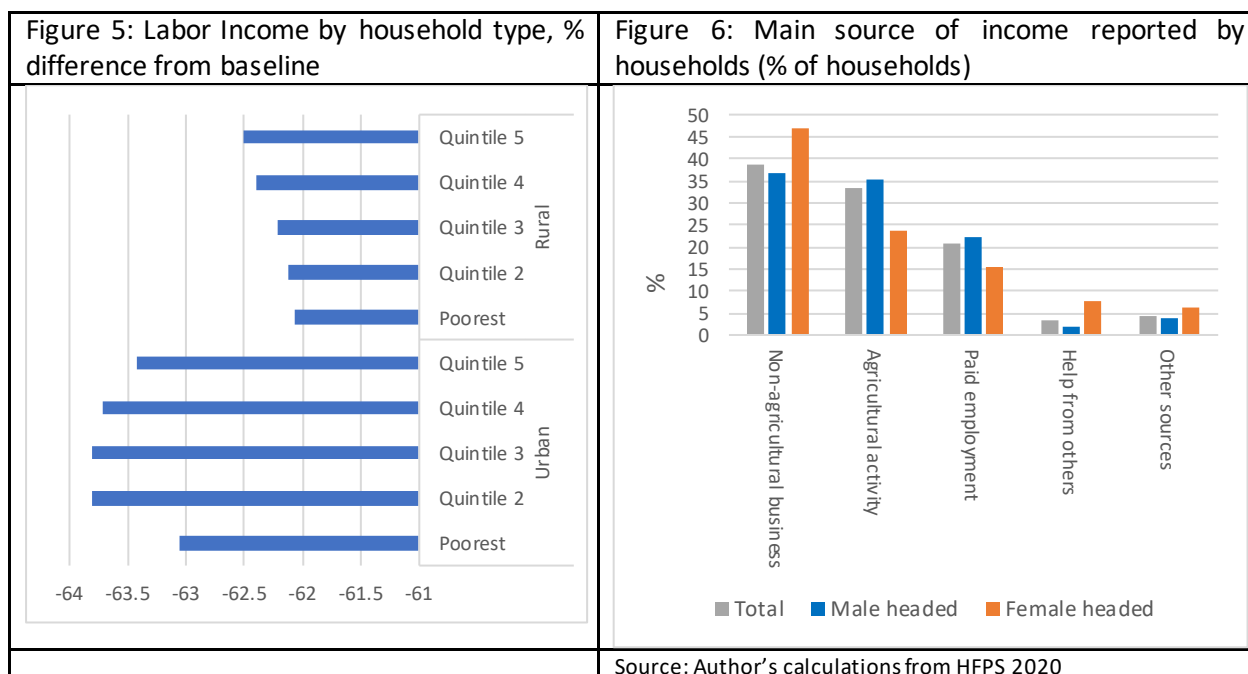
3.2. Impact on female-headed households

Around 23 percent of Chad's households are female-headed, divided equally among rural and urban areas. Male-headed households tend to be two-parent households, whereas 70 percent of the female heads in Chad are either widowed, divorced, or separated (Figure A. 2 in the Appendix). Female-headed households face particular financial constraints related to often being single-income households and having a larger dependency ratio.[11] Based on ECOSIT 4, female working members of female-headed households are more likely to work as non-salaried non-farm workers or workers in non-family farms than female workers in male-headed households likely to work as family farm workers or be owners of family farms. There is an over-representation of female-headed households among the poorest urban quintile compared to male-headed households, and an under-representation in the highest urban quintile despite this group being the recipient of most of the household transfers of remittances from abroad[12] (Figure A. 4 in the Appendix). Almost 20 percent of the urban female-headed households fall into the poorest urban quintile versus 14 percent of male-headed households.

Results from the COVID-19 HFPS show that three months into the pandemic, 63 percent of the interviewed households reported having experienced a decrease in income from their main source of income. Non-agricultural business income is the main source of income reported by 39 percent of the households interviewed in the COVID-19 HFPS; followed by agricultural income, paid employment, and domestic remittances (Figure 6). There are no statistically significant differences between the proportion of total male and female-headed households reporting decreased income (Table 6, Column 1). However,

---

[11] These characteristics are not unique to female headed households in Chad. See Milazzo and van de Walle (2015) for more on female headed households in Africa.

[12] The share of remittance in income is very low in Chad. For comparison, Chad and Senegal have similar proportion of migrants relative to their total population, but the share of remittances in income in Senegal is 27 percent while the corresponding share in Chad is only 5 percent.

there is heterogeneity in the main source of income and reported changes by gender of head of households.

Table 6: Loss in income during COVID-19 from household's income source

Variables	(1) Main Income	(2) Farm Income	(3) Business Income	(4) Wage Income
Gender of household head (1=female hh, 0=male hh)	-0.092	-0.281	0.681***	-0.799**
	(0.136)	(0.187)	(0.173)	(0.321)
Education level of household head (1=primary)	-0.152	-0.209	0.348	0.403
	(0.145)	(0.172)	(0.273)	(0.496)
Education level of household head (2=secondary)	-0.224*	-0.393**	0.650***	0.389
	(0.128)	(0.163)	(0.214)	(0.300)
Education level of household head (3=post-secondary and above)	-0.122	0.265	0.647***	0.431*
	(0.167)	(0.351)	(0.237)	(0.259)
Sector (urban=1, rural=0,)	0.134	0.166	-0.235	-0.503*
	(0.084)	(0.121)	(0.144)	(0.283)
Household size	-0.002	0.009	-0.015	-0.033
	(0.014)	(0.018)	(0.027)	(0.033)
Constant	0.477***	0.436***	0.693***	0.429
	(0.123)	(0.149)	(0.263)	(0.343)
Observations	1,724	690	657	344

Robust standard errors are reported in parentheses (*** p<0.01, ** p<0.05, * p<0.10). Each column reports results from a single probit regression of a binary variable equal to 1 if the respondent's household experienced loss in income and 0 otherwise. "main_inc_dwn" represented a loss in income from the main income source of the household. The columns show the dependent variables associated with income loss in farm income, business/enterprise income, and wage income, respectively, for households that reported these sources as their main income source prior to COVID-19.

Regression results presented in Table 6 show female-headed households are significantly more likely to have lost income from non-farm enterprise, and male-headed households are significantly more likely to have lost income from wage employment. Among the surveyed sample, only 15 percent of the female-headed households reported having earned income from wage employment by any of the household members, versus 22 percent in male-headed households. It is notable here that wage employment is far less common among women in Chad and in the agriculture sector. They work largely as unpaid laborers in family enterprises (Ngatia et al., 2021), where a reduction in wage income would not be captured. Wage employment among the female heads of households is even smaller; only 14 percent of the surveyed sample of female heads worked in salaried employment. Most of them (63 percent) worked on their own account (versus 47 percent of male heads).

Although income losses during the pandemic have been incurred in all income sources, we focus on non-farm enterprise income as this is the main income source reported by the majority of female-headed households, and enterprise income in the service sector is the most affected by lockdown and other

COVID-19 spread mitigation measures. Business closure due to COVID-19 and lack of customers (which could partially be attributed to the pandemic) are the most widely reported reasons both by male and female-headed households for loss in enterprise income (Figure 7).

Female-headed households who earn their main livelihood from enterprise income have particularly experienced income losses (Table 6, Column 3). Compared to male-headed households, a larger proportion of female-headed households reported non-agricultural business or enterprise income (47 percent) and help from others as their main source of income. These are also income sources from which the largest proportion of total households reported having decreased income (around 70 percent). Of the male-headed and female-headed households who reported enterprise income as their main source of income, a statistically significant larger portion of female-headed households reported decreased income (81 percent) compared to male-headed households (72 percent).

The significant coefficient for female-headed households reporting income loss from non-farm enterprises during COVID-19 is not unexpected. From Ngatia et al. (2021), which uses ECOSIT4 (household budget survey), we know that although women own 57 percent of the non-farm enterprises, they make 77 percent less profit than male-owned enterprises. Female entrepreneurs, on average, have a lower level of education and have less access to electricity, running water, machinery, or telephone for their business. Female entrepreneurs who do have access to electricity or phone have lower returns from owning them, indicating underlying discrimination. Although their analysis is not exclusive to female heads of households, [13] but to all women, we could assume that female heads of households face similar constraints in running their business if not additional and more severe constraints. These existing vulnerabilities could render them more at risk of reduced income during the COVID-19 pandemic. For example, if customers are unable or unwilling to visit the enterprises during COVID-19 to buy commodities physically, they may alternatively place orders through the telephone; and women have less access to such technologies.

---

[13] In fact, 27 percent of the female entrepreneurs in their nationally representative sample were divorced, widowed, or separated, as such by default female heads of households.
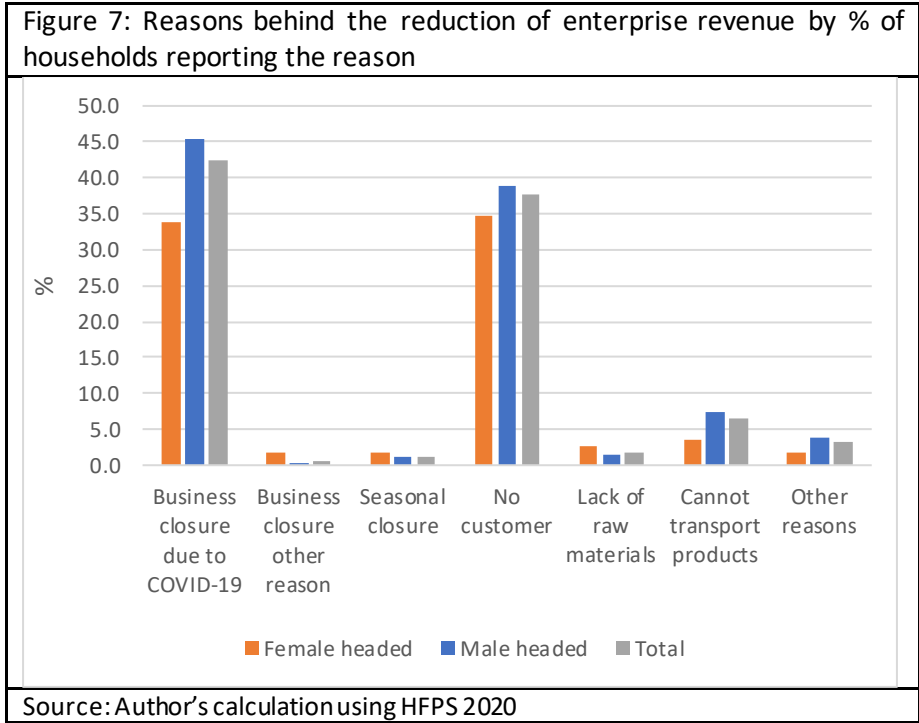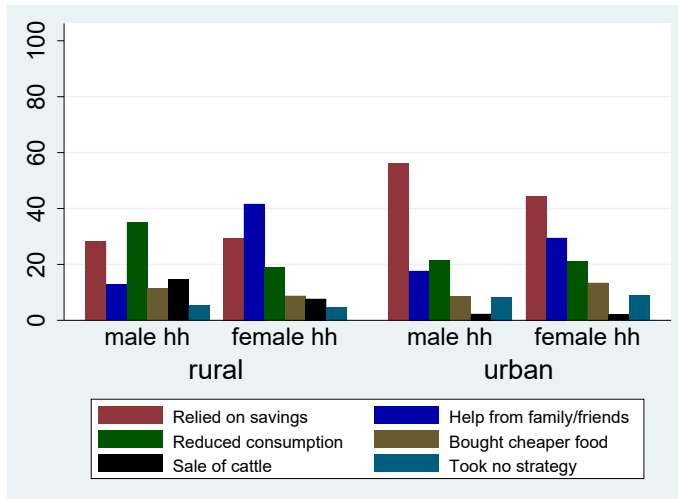
Figure 7: Reasons behind the reduction of enterprise revenue by % of households reporting the reason

Source: Author's calculation using HFPS 2020

Figure 8: Coping strategy adopted by households (% of total households) in response to any shock during COVID-19

Source: Author's calculation using HFPS 2020

Increases in food price and illness of income-earning members (both in rural and urban areas) and job loss and business closure (more in urban areas) are the most reported shocks by households. In urban areas, households are significantly more reliant on savings and help from family and friends as a coping strategy, whereas in rural areas, they are more likely to reduce consumption and sell animal livestock in response to the experienced shocks (Table 7). This variation in rural-urban coping strategies is not unexpected. Using similar COVID-19 phone surveys for four SSA countries, Josephson et al. (2020) estimate that rural

15

households are significantly more likely to sell assets to cope, while urban households are more reliant on family and friends and reduction of non-food consumption.

While male and female-headed households use common coping strategies, female-headed households are significantly more reliant on family and friends' assistance (Table 7, column 2, significant at 1 percent level). Even in urban areas, where the most widely used coping strategy for any type of shock is to draw on savings (49 percent), a smaller proportion of female-headed households relied on savings during the survey period, whereas a higher proportion relied on assistance from family and friends compared to male-headed households. In rural areas among male-headed households, the more common methods are to rely on savings (25 percent) and to decrease consumption (26 percent); however, the most widely adopted coping strategy by rural female-headed households is reliance on assistance from family and friends.

Table 7: Adopted coping strategies during COVID-19 in response to difference shocks

Variables	(1) Relied on savings	(2) Help from family/friends	(3) Reduced consump.	(4) Bought cheaper food	(5) Sale of animal livestock
Gender of household head (1=female hh, 0=male hh)	-0.070	0.659***	-0.294*	-0.073	-0.096
	(0.154)	(0.150)	(0.164)	(0.172)	(0.230)
Education level of household head (1=primary)	-0.525***	-0.104	0.299*	0.124	0.598***
	(0.148)	(0.160)	(0.156)	(0.185)	(0.202)
Education level of household head (2=secondary)	-0.243*	-0.364**	0.154	-0.129	0.555***
	(0.145)	(0.155)	(0.142)	(0.180)	(0.193)
Education level of household head (3=post-secondary)	-0.373**	-0.324**	-0.020	0.086	0.738**
	(0.168)	(0.145)	(0.221)	(0.312)	(0.334)
Sector (urban=1, rural=0)	0.742***	0.168*	-0.323***	-0.076	-1.027***
	(0.090)	(0.093)	(0.095)	(0.118)	(0.188)
Household size	0.024	-0.030	0.015	-0.020	0.041**
	(0.016)	(0.020)	(0.017)	(0.020)	(0.019)
Constant	-0.592***	-0.821***	-0.593***	-1.092***	-1.630***
	(0.130)	(0.157)	(0.138)	(0.172)	(0.184)
Observations	1,578	1,578	1,578	1,578	1,578

Robust standard errors are reported in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.10$). Each column reports results from a single probit regression of a binary variable equal to 1 if the respondent's household adopted the coping strategy, 0 otherwise.

3.3. Other impact channels

There are several indirect transmission channels on the economic impact that we have not modeled in our CGE simulation or econometric regression due to complexity and unavailability of data, but it is worth discussing and could potentially have a long-lasting impact on an individual women's life.

The increase in gender-based violence (GBV)[14] due to COVID-19 has been widely recognized (Peterman et al., 2020). Gender-based violence in the forms of FGM/E, child marriage, and physical or intimate partner violence is pervasive in Chad (Table A.2 in the Appendix). In a study of GBV and its impact on women's resilience, Le Masson et al. (2019) reports that women in Chad highly reported GBV in the form of denial of resources and forbidding women from earning. The increase or likely increase in GBV in Chad during COVID-19 has direct and indirect long-term impacts on women's ability to participate in labor markets and generate income. GBV limits survivors' physical and/or mental ability to maintain their domestic and productive activities. During economic stresses, there is also a tendency among Chadian men to adopt the "flight" phenomenon of abandoning family (observed post-disaster in other parts of the world as well), which gives rise to households headed by females with their single or no income and who find it difficult to access their (ex-) husband's resources (Le Masson et al. 2019).

Although we could not find any GBV survey results conducted during COVID-19 for Chad, UNFPA reports through studies in Mali and Cameroon that there has been increased accounts of GBV in West and Central Africa, the main ones being in the forms of domestic violence and sex for survival. Additional girls will be subjected to FGM/E as some of the most effective prevention mechanisms which require community or group gatherings are disrupted due to COVID-19 (UNFPA 2020).

The pandemic can interrupt adolescent girls at a critical juncture in their life trajectory by affecting their education and health, which will have economic impacts in their adulthood. Although gender gaps in school attendance have reduced over the years in Chad, girls' school attendance remains lower than boys' (Ngatia et al., 2021). There is an increased risk of girls dropping out of school during the pandemic and never returning, which would exacerbate this gap. Evidence from past pandemics such as the 2014 Ebola Crisis in Sierra Leone reveals long-lasting impacts on girls' school enrollment, increase in child marriage when girls drop out of school due to school closures, and their adoption of risky behaviors, which leads to early childbearing (Bandiera et al. 2018). Child marriage also increases as households marry off their daughters for dowry during economic stress, as evidenced in Chad (Le Masson et al. 2019).

Chad has notable gender gaps in learning outcomes (Ngatia et al. 2021), and hence women in the workforce are less educated and less skilled. Results from HFPS reveal only 15 percent of households with a child in school before COVID-19 school closures were involved in learning activities at home after closure. With school closures and learning at home, the gender gap in learning outcomes could widen because young girls spend more time helping with increased household chores and gender gaps in access to information and technology required for home-based learning.

4. Conclusion

In this paper, we used CGE model-based simulations to assess the gender dimensions of the impact of COVID-19 on economic outcomes, i.e., labor force participation, employment, wages, and earnings. We also leveraged the COVID-19 high-frequency phone survey (HFPS) to assess the actual impact of COVID-19 on female-headed households, which comprise 23 percent of Chad's households. To sum up, the COVID-19 pandemic will have a disproportionately higher negative impact on women in urban areas. The CGE simulation results suggest that more women than men working in paid jobs might lose their jobs. The

---

[14]Gender-Based Violence (GBV), sometimes also referred to as Sexual and Gender-Based Violence (SGBV) is any harmful act of sexual, physical, psychological, mental, and emotional abuse that is perpetrated against a person's will and that is based on socially ascribed (i.e. gender) differences between males and females.

situation is potentially dire, especially in service sectors, where most women are employed in urban areas. Gender-related dynamics mainly drive these results. The significant pay gap and employment rate of women results in a lower contribution to sector value-added. Further, lower productivity than men also makes women a less favorable substitute for other production factors (i.e., male labor or capital). Eventually, women could become easily substitutable with other factors of production during the time of crisis.

However, women in rural areas will be less affected as they work mainly in agriculture. Female-owned farms other than those producing food crops will be affected less. The advantage of women in agriculture is not because their farms are more productive but mainly due to their low reliance on modern inputs. As imports are squeezed, inputs such as fertilizer and pesticides will become inaccessible. The latter will have a higher impact on male-owned farms, making women relatively better-off. But such an effect will not make women farmers better-off compared to baseline. The disadvantage of female-owned food crop farms is their higher labor intensity.

The COVID-19 pandemic has notably impacted the income of households, particularly female-headed households, who earn their main livelihood from enterprise income. Business closure due to COVID-19 and lack of customers (which could be partially attributed to the pandemic) are the most widely reported reasons both by male and female-headed households for loss in enterprise income. Results from the phone survey provide evidence that a disproportionate share of female-headed households has incurred losses from enterprise income. This is not unexpected. Although women own 57 percent of the non-farm enterprises, they make 77 percent less profit than male-owned enterprises. Female entrepreneurs, on average, have a lower level of education and have less access to electricity, running water, machinery, or telephone for their business.
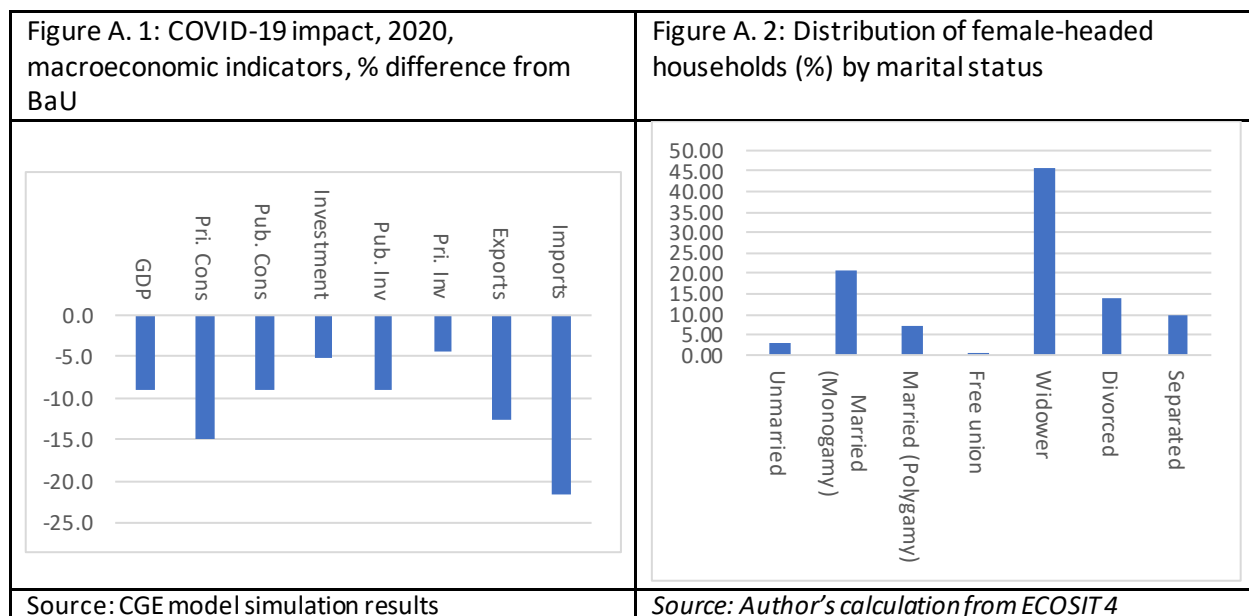
Increases in food price and illness of income-earning members (both in rural and urban areas) and job loss and business closure (more in urban areas) are the most reported shocks by households. While both male and female-headed households are using common coping strategies during the pandemic, female-headed households in rural and urban areas were significantly more reliant on aid from family and friends and less on savings or credit sale of assets. Even in urban areas, where the most widely used coping strategy for any type of shock is to draw on savings (49 percent), a smaller proportion of female-headed households relied on savings during the survey period.

Our CGE simulation-based results assumed that COVID-19 would not trigger the impact channels beyond 2020. By the end of 2020, we know that impact channels could be longer-lasting into 2021, and our CGE simulation-based negative impacts could be stronger and longer. As our results show, much of these gendered economic impacts are due to pre-existing gender dynamics in labor structure. It is imperative to recognize the heterogeneity in women's livelihoods to identify affected households and individuals and design policy responses accordingly. Gender-sensitive policy responses can help alleviate the economic stresses for women across various sectors and help Chad build back stronger from potential economic damage.

References

Bandiera, Oriana, Niklas Buehren, Markus P. Goldstein, Imran Rasul, and Andrea Smurra. 2019. *The Economic Lives of Young Women in the Time of Ebola: Lessons from an Empowerment Program*. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/31219

Burns, A., Dudu, H., Zeshan, M., 2020, Climate Change Damages, Mitigation and Adaptation in Pakistan: A CGE Model and Analysis, World Bank, Washington, DC (in press)

Josephson, A., Kilic, T., & Michler, J. D. (2020). *Socioeconomic Impacts of COVID-19 in Four African Countries*. Policy Research Working Paper; No. 9466. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/34733 License: CC BY 3.0 IGO.

Korkoyah, Dala T., and Francis F. Wreh. 2015. Ebola Impact Revealed, Liberia Ministry of Gender Children and Social Protection. Monrovia Online Report. Available at https://www-cdn.oxfam.org/s3fs-public/file_attachments/rr-ebola-impact-women-men-liberia-010715-en.pdf

Le Masson, Virginie, Colette Benoudji, Sandra Sotelo Reyes, and Giselle Bernard. 2019. "How Violence against Women and Girls Undermines Resilience to Climate Risks in Chad." Disasters 43 (S3): S245-70.

Milazzo, Annamaria; van de Walle, Dominique. 2015. Women Left Behind?: Poverty and Headship in Africa. Policy Research Working Paper; No. 7331. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/22212 License: CC BY 3.0 IGO."

Ngatia, M., Tchana, F.T., Dudu, H., Kassim, O.M., Ahmed, R., Kabir, K., and Decker, A. 2021. *The Economic Benefits of a Post-COVID-19 Gender-Conscious Society*. The World Bank: Washington DC (in print)

van der Mensbrugghe, Dominique. 2020. Mitigation Adaptation and Natural Resources Applied General Equilibrium (MANAGE) Model Documentation. Unpublished document available upon request.

Peckham, H., de Gruijter, N.M., Raine, C., Radziszewska, A., Ciurtin, C., Wedderburn, L.R., Rosser, E.C., Webb, K. and Deakin, C.T., 2020. Male sex identified by global COVID-19 meta-analysis as a risk factor for death and ITU admission. Nature communications, 11(1), pp.1-10.

Peterman, Amber, Alina Potts, Megan O'Donnell, Kelly Thompson, Niyati Shah, Sabine Oertelt-Prigione, and Nicole van Gelder. 2020. Pandemics and Violence Against Women and Children. Working Paper No. 528. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/pandemics-and-violence-against-women-and-children

UNFPA. 2020. *Impact of the COVID-19 Pandemic on Family Planning and Ending Gender-based Violence, Female Genital Mutilation and Child Marriage*. New York. https://www.unfpa.org/resources/impact-covid-19-pandemic-familyplanning-and-ending-gender-based-violencefemale-genital.

UN Women. 2020. Policy brief: The Impact of COVID-19 on Women. New York. https://www.unwomen.org/en/digital-library/publications/2020/04/policy-brief-the-impact-of-covid-19-on-women

Djiofack, C.Z., Dudu, H., and Zeufack, A.G., 2020. Assessing COVID-19's economic impact in sub-Saharian Africa: Insights from a CGE model, in Simeon Djankov and Ugo Panizza (Eds), COVID-19 in Developing Economies, CEPR/International Development Policy journal, VOX-EU, https://voxeu.org/content/covid-19-developing-economies.

Appendix

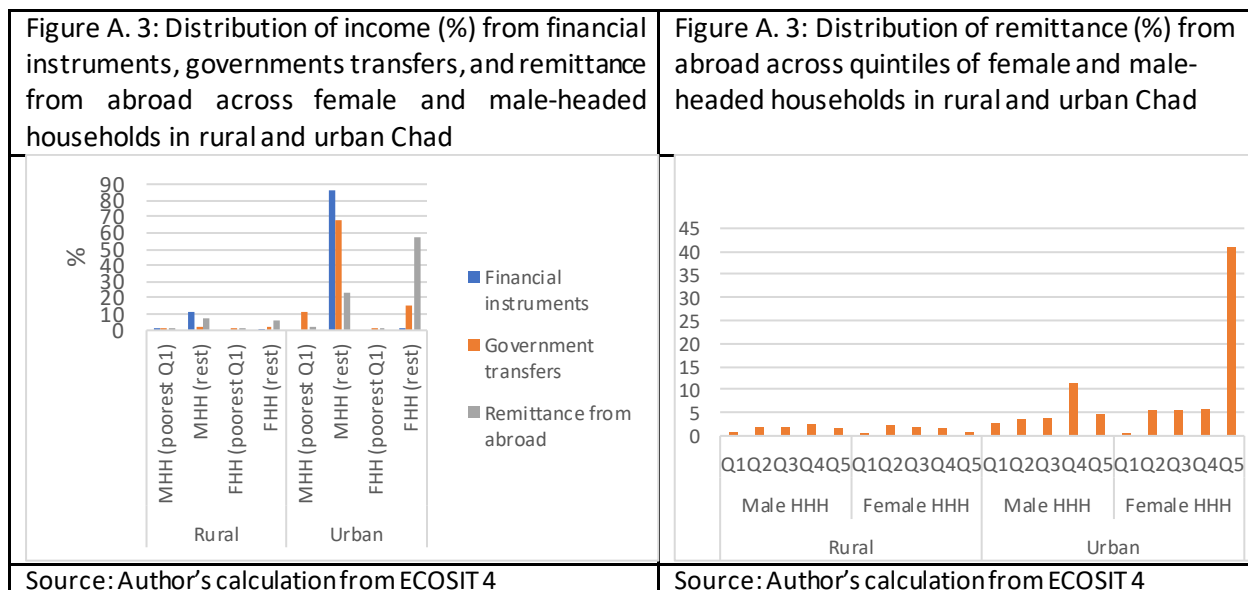| Figure A. 1: COVID-19 impact, 2020, macroeconomic indicators, % difference from BaU	Figure A. 2: Distribution of female-headed households (%) by marital status
Source: CGE model simulation results	*Source: Author's calculation from ECOSIT 4*

The reduction in GDP growth is driven largely by a decline in private consumption (15 percent) as well as government consumption and investment (9 percent), private investment (5 percent), and exports by more than 12 percent. The reduction in imports is much higher at 21 percent, reflecting the dependence of Chad on export revenues and foreign exchange flows to be able to import. The significant drop helps reduce the current account deficit by almost one-third. Assuming the negative impact of the pandemic on macroeconomic balances does not cause a significant long-term impact except for exports and imports, which also decline in 2021.

Table A. 1: Macroeconomic impacts of COVID-19 (percent change from baseline)

	2020	2021	2022	2023	2024	2025
National accounts						
GDP at constant prices	-9.0	-0.1	-0.1	-0.1	0.0	0.0
Private consumption	-14.9	-0.3	0.0	0.0	0.0	0.0
Public consumption	-9.0	-0.1	-0.1	-0.1	0.0	0.0
Investment	-5.1	0.3	-0.2	-0.1	-0.1	0.0
Public Investment	-9.0	-0.1	-0.1	-0.1	0.0	0.0
Private Investment	-4.3	0.4	-0.2	-0.1	-0.1	0.0
Exports	-12.6	-2.2	-0.7	-0.3	-0.1	-0.1
Imports	-21.7	-1.7	-0.5	-0.2	-0.1	-0.1
Balance of payments						
Current account balance	-33.20	0.00	0.00	0.00	0.00	0.00
Balance on goods and services	-10.35	0.00	0.00	0.00	0.00	0.00
Labor Market						
Employment	-5.56	-0.04	-0.01	-0.01	-0.01	-0.01
Population	0.00	0.00	0.00	0.00	0.00	0.00
Source: CGE model simulation results						

Figure A. 3: Distribution of income (%) from financial instruments, governments transfers, and remittance from abroad across female and male-headed households in rural and urban Chad	Figure A. 3: Distribution of remittance (%) from abroad across quintiles of female and male-headed households in rural and urban Chad
Source: Author's calculation from ECOSIT 4	Source: Author's calculation from ECOSIT 4

Table A. 2: Prevalence data on different form of violence against women in Chad			
Form of violence	Prevalence (%)	Indicator definition	Source
Female genital mutilation/excision	38%	Percentage of girls and women aged 15 to 49 years who have undergone FGM/e	Source: UNICEF global databases 2017, based on Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), and other nationally representative surveys
Child marriage	67%	Percentage of women aged 20 to 24 years who were first married or in union before age 18.	Source: UNICEF global databases, 2018, based on Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS) and other nationally representative surveys.
Lifetime Physical and/or Sexual Intimate Partner Violence	29%	Proportion of ever-partnered women aged 15-49 years experiencing intimate partner physical and/or sexual violence at least once in their lifetime.	UN Women Global Database on VAW, based on Institut National de la Statistique, des Études Économiques et Démographiques (INSEED), Ministère de la Santé Publique (MSP) et ICF International, 2014-2015.
Physical and/or Sexual Intimate Partner Violence in the last 12 months	18%	Proportion of ever-partnered women aged 15-49 years experiencing intimate partner physical and/or sexual violence in the last 12 months.	Same as above
Note: Data on gender-based violence is globally under-reported and especially so in Chad, where violence in many of its forms is not considered to be harmful according to traditional practices and customary rules.			