MOHAMMED VI POLYTECHNIC UNIVERSITY | FACULTÉ DE GOUVERNANCE, SCIENCES ECONOMIQUES ET SOCIALES

A socio-economic impact analysis of the political crisis in Burundi with a focus on children: A macro-micro framework

Luc Savard

CAHIER DE RECHERCHE
22-05

A socio-economic impact analysis of the political crisis in Burundi with a focus on children: A macro-micro framework

L. Savard[1]

Abstract

In this paper we present an social and economic impact analysis of the Burundi political crisis (2015 to 2017) performed with a macro-micro-simulation framework. To achieve these objectives, we constructed a macro-micro analytical framework that includes a computable general equilibrium (CGE) model and a micro-simulation (MS) model. This framework allows us to link shocks of a more macroeconomic nature such as reductions in foreign aid, reductions in the supply of public services, on household and more specifically on children. Scenarios were designed and applied to represent some of the manifestations of the political crisis. The distributional analysis is performed with the standard indices (FGT and Gini) and we extend our social analysis on three social indicators by combining results from our CGE model and elasticities linking growth and social indicators from the literature. The macroeconomic and sectoral results show significant negative effects on GDP, skilled employment and unemployment. The social impact analysis carried out with the results of the model and the actual data observed show a very significant negative impact on the three social indicators selected, i.e. infant mortality (under 5 years of age), net enrollment rate and school retention rate.

Key words: Social impact, CGE model, Microsimulation, Children, Burundi
JEL codes: I15, I25, H51, H52 ; I32 ; C68

[1] Full Professor –AIRESS, Mohammed VI Polytechnic University - Campus Rabat-Salé – Morocco – Contact : savard.LUC@UM6P.ma.

1. Introduction

After years of civil unrest resulting from the catalyst of the 1993 coup d'état, the Arusha Agreement, ratified in 2000, has allowed Burundi to experience a period of social calm over the past decade. The agreement, which included judicial reform to reduce Tutsi dominance and military reform to reduce Tutsi dominance and facilitate the integration of rebel forces into the Burundian army (Boshohff et al 2010), allowed for elections to be held in 2005, which were won by the CNDD-FDD party. Following the 2005 elections, Pierre Nkurunziza was elected by the National Assembly and the Senate for a five-year term

This period of social calm was disrupted by the incumbent president's decision to run again in the 2015 presidential election and the events that followed. Opponents of the incumbent's two-term candidacy argue that under the constitution, an individual's eligibility to run for president is limited two terms while supporters of the president submit instead, that according to their interpretation of the constitution, the incumbent remains eligible for a third term given that his first term had not been won in an election by universal suffrage (IRIS 2016). While the initial protests were mostly peaceful, the attempted coup orchestrated by Burundian army officers marked the beginning of the violence and subsequent repression (IRIS 2016)

A February 2017 report by the United Nations Secretary-General on Burundi noted, among other things, that human rights violations continue at an alarming rate. At the same time, the sexual and gender-based violence reported by women and girls while fleeing the country could be explained by the prevailing climate and distrust of the judicial system (United Nations - Security Council 2017). Under these circumstances, a political solution is certainly desirable as evidenced by the comments of France's Deputy Permanent Representative to the UN, Mr. Lamek, to the effect that the solution is necessarily political and inclusive (RFI 2016). However, many irritants on both sides complicate a political solution. For example, the assassination of General Nshimirimana, considered the president's right-hand man, does not facilitate the negotiation of a political exit to the crisis, as the government refuses to dialogue with individuals suspected of having participated in the 2015 coup attempt and with the leaders of the "Stop the Third Mandate" movement (United Nations-Human Rights Council 2017). In 2017, in the context of the inter-Burundian dialogue, the facilitator issued a statement confirming the legitimacy of the third presidential term while recommending that the dialogue focus on the preparation and holding of free and fair elections in 2020, much to the consternation of some opposition leaders and members of civil society (United Nations Human Rights Council 2017).

Burundi's level of development, as measured by the Human Development Index (HDI), is one of the lowest in the world as evidenced by the country's 185th ranking (UNDP 2019). Moreover, considering that nearly 82% of the Burundian population is in a situation of multidimensional poverty (UNICEF 2017c)

and that the country has one of the highest rates of malnutrition, despite the fact that agriculture is the sector that contributes the most (about 40%) to the country's gross domestic product (GDP) and employs nearly 80% of the population (Deloitte 2016), it is possible to see the magnitude of the issues and challenges facing the country.

On the one hand, coffee and tea are the country's two main exports, accounting for nearly 90% of foreign exchange earnings alone (CIA-2017). Given the preponderance of these commodities in the country's total exports, Burundi is incidentally particularly vulnerable to fluctuations in the price of these goods as well as to weather conditions that may affect the harvest. On the other hand, considering that the weakness and lack of diversification of the country's economy, it is therefore highly dependent on international aid. In this regard, the international aid on which the country depends represented about 42% of Burundian national income in 2014 (CIA 2017). Moreover, the European Union, Burundi's largest donor, announced in the spring of 2016 that it was suspending financial aid to the Burundian government because of the crisis. Although it intends to maintain its support to the population of 430 million euros for the period 2015-2020 (Le Monde 2017), the impact of the withdrawal of international aid negatively affected the budget and the Burundian economy[2].

The socio-economic impacts of the crisis that has been raging since 2015 are non-negligible. After experiencing average annual growth of 4% between 2010 and 2014, Burundi's GDP fell by just over 4% in 2015 and the budget deficit increased from 1.2% of GDP (2014) to 5.7% (2015) (OECD 2016). The GDP decreased again in 2016 by 0.6% and has been positive but remained below 1.8% since 2017 (World Bank 2022[3]). In the same vein, budget allocations to the education, health, and water and sanitation sectors decreased by 30%, 54%, and 72%, respectively (UNHRC 2017) in the midst of the crisis. In a context where the large share of investments in these sectors are provided by external resources, the progress made in recent years could be diminished, compromising Burundi's progress towards achieving the Sustainable Development Goals. For example, in education, it is argued that in addition to difficulties in recruiting teachers, the parental contribution required for children's education has increased significantly during the crisis, which has an impact not only on school dropout (FPRSC-2017), but also on inequalities, since the poorest households often cannot absorb such an increase in parental contributions (FPRSC-2017).

Perhaps one of the most visible manifestations of the impact of the crisis on the population is the

[2] EU lifted restriction to providing aid to Burundi in February 2022: https://www.consilium.europa.eu/fr/press/press-releases/2022/02/08/burundi-eu-lifts-existing-restrictions-under-article-96-of-the-acp-eu-partnership-agreement/
[3] The growth was 0.5% in 2017, 1,6% in 2018, 1.8 in 2019 and 0.3 in 2020 based on World Bank 2022).

increasing migration movements out of the country between 2015 and 2017. Indeed, the number of Burundians who have sought refuge in another country, mainly in Tanzania (238,061) and Rwanda (84,880) (UHCR 2017a), has risen to 405,106 from a total of only 10,323 as of April 30, 2015 (UHCR 2017b). In addition, the number of internally displaced persons stood at 149,028 as of March 2017, of which 36% were attributable to the current socio-political climate while 63% of displacement was due to natural disasters having occurred (IOM 2017). The large number of migrants, whether leaving the country or moving within the country itself, can only contribute to further weakening an agriculture-based economy with a precarious food situation. Moreover, the number of people exposed to food insecurity has risen from just over 700,000 to 3 million (UNHRC 2017).

The economic and social impact analysis including distributional analysis of shocks or economic policies can be done with two main analytical tools, namely microeconomic models in partial equilibrium (microsimulations-MS) or in a macro-micro general equilibrium analysis framework. Models (MS) that capture the effects on the behavior of households and individuals are essential for distributional analysis because they take into account a large number of households and in order to implement a rigorous distributional analysis. They therefore make it possible to capture the winners and losers of a reform or shock on an economy at the level of households or individuals (Bourguignon and Spadaro 2003). The problem with this type of model is that the analytical framework lacks at least two elements. First, partial equilibrium only captures the effects on households of price changes or income changes. The two cannot be captured simultaneously. For example, to analyze the impact of the food crisis in Sub-Saharan Africa, Wodon and Zamen (2009) capture only the negative effects on the price of food goods. They cannot capture the effects of this shock on changes in household income. Furman (2006) analyzes the poverty impact of a tax reform by considering only the impact on household income and not the impact on market prices. Second, if the analyst wishes to understand the transmission mechanisms between an economic shock and household welfare, he or she must use an analytical tool that captures these transmission mechanisms. In general, microeconomic models can capture some transmission mechanisms but cannot capture interactions between sectors, do not take into account the elements or contribution of the entire economic structure in the analysis.

For their part, CGE models capture the effects on winners and losers at the sectoral level, the impact on macroeconomic variables and general equilibrium price effects. In other words, the application of an exogenous shock or an economic policy does not only have an impact on the targeted market, but the shock reverberates throughout the economy through the interactions and interrelations between these markets.

In view of this constant, since the early 1990s, analysts have been using CGE models to carry out studies analyzing the distributive and poverty impacts of economic reforms or exogenous shocks. Initially, these modelers worked with representative agent models (Chia et al (1994), de Janvry et al (1991) or Decaluwé, Patry, Savard and Thorbecke (1999)). With this approach, the modelers decompose the population into several representative households and after simulation, they use the variation in income of the representative household to infer a variation in income to all households in these groups. This approach does not capture changes in the within-group income distribution, while Huppi and Ravallion 1991 and Savard 2005, show that these changes can be more important than changes in the between-group distribution. Furthermore, Savard (2005) has shown that the results of poverty analysis with the CGE representative agent approach can be completely reversed using a joint CGE-Microsimulation approach. Decaluwé, Dumont and Savard (1999) proposed combining a CGE model with a MS model in order to perform more rigorous distributional analyses. The idea of combining these analytical tools is natural because the two tools are flexible enough to make them compatible, similar hypotheses can be formulated and they are used in a counterfactual analysis framework.

Various approaches to joint use of CGE-MS models have been proposed in the literature and Cockburn et al (2014) present a comprehensive review of these approaches highlighting the advantages and disadvantages of each approach. The most commonly used approach is the sequential (top-down) CGE-MS approach. The main reason for its greater use is that it is easier to implement while incorporating the key elements for a distributional analysis. In addition, it is less demanding in terms of data quality and offers great flexibility in adapting to particular situations (Cockburn et al. (2014). Exemples of applications in Afica include inter alia Boccanfuso et al (2018), De Quatrebarbes et al (2016), Sindu et al (2016) and Cockburn et al (2016).

As for using this CGE-MS framework to analyse the socio-economic impact of policy reform or external shocks on children, we only found two applications in the literature. Robichaud et al (2014) analyse the impact of incrising public education spending on growth and povety in Uganda and Cockburn et al (2016) use this framework to investigate three policy interventions aimed at reducing child poverty in Burkina. Both of these papers focus on increasing public spending on health and/or education on child poverty and they find positive effects of this increase spending.

The objective of this paper is to perform and comprehensive economic and social impact analysis of the political crisis in Burundi including a distributional analysis. We extend from the literature by using the CGE model results in combination with external elasticities to capture potential impact on other social indicators with a particular focus on children. For this socio-economic impact analysis on Burundi, the top-down macro-MS approach was chosen. To our knowledge, these two models are the first to be built and

used jointly for Burundi. They allow us to analyze the effects of major shocks on the economy on economic performance (efficiency) but also on social impact (equity and social indicators) through the impact on various indicators and measures of well-being. To meet the objectives of this paper, we designed five scenarios depicting some manifestations of the political crisis in the country. The rest of this paper is structured as follows: The models are presented in section 2, the methodology of the distributional analysis and the household categories are described in section 3, in section 4 the scenarios are presented followed by the analysis of the results, and we conclude the report in section 6.

2. The CGE model and the microsimulation model

2.1 The computable general equilibrium model

The CGE model constructed is based on the EXTER model of Decaluwé, Martens and Savard (2001) as a starting point. This model is then integrated into a macro-micro impact analysis framework by combining it with a micro-simulation model with behaviors using the sequential (top-down) approach as described in Cockburn et al (2014). This is a CGE model of a small open economy where world prices are exogenous and therefore the country has no influence on world prices. This model is based on the SAM for 2013 constructed by Savard (2016) which has 18 industries. The output of production sectors is determined by several factors, including initial capital, labor availability and costs, and input prices. Producers minimize their production costs under the constraint of a nested production technology with a Cobb-Douglas linking labour and capital. Producers can use skilled and unskilled labor for production linked with a CES function and intermediate inputs are linked in a Leontief fixe share function.

For the agents in the model, only the representative household behaves in an optimal way, i.e. it maximizes its utility under budget constraints. The household has a Stone-Geary utility function. This captures the fact that a large part of the budget of poor households in the country is devoted to basic needs and therefore an increase in the price of these goods will have significant consequences on the welfare of the household (Savard 2005).

The government does not optimize. It obtains its revenues from taxation, revenues from public enterprises and foreign aid and devotes an exogenous budget to public expenditure and saves the balance for public investment. Note that depending on the scenarios applied, we modify this assumption to capture the mechanics of the fiscal shock.

Firms obtain their income from capital income, transfers from abroad and from the government and they pay dividends and taxes. Their savings are made up of the balance between their income and their expenses. The other agent is NPI (non profit institutions) that receive transfers from other agents and spend their

income based on fixed budget share and a fix savings rate.

One of the specificities of our model is to take into account the segmentation of the labor market. We consider that there are skilled (formal) and unskilled (informal) workers. In addition, we introduce unemployment as observed in the 2013/14 ECVMB survey data. In the model, we allow for movement between the two labor markets and between unemployment and the two labor markets and vice versa in the same fashion as Savard (2010). This allows us to capture the negative impacts associated with the decline in output in both the private and public sectors. The different markets for goods and services are balanced by an adjustment of prices. It is the same for the labor market in the unskilled/formal sector but for the skilled/formal labor market, the wage is rigid and the adjustment of this market is done by a variation of unemployment.

2.2 The microsimulation model

2.2.1 Description of the microsimulation model

The MS model with consumption behavior and labor supply is inspired by the one proposed by Bourguignon and Savard (2008) in a simplified version. It is calibrated on data from the 2013/2014 Burundian household living conditions survey-ECVMB. The model includes 6681 households of this survey[4]. The MS model allows us to calculate idyosycratic household levels of employment/unemployment, income, expenditure, savings and welfare change. These variations are generated by using the CGE model's new equilibrium prices and employment/unemployment levels into the MS model. Extensive data processing was required from the survey data to build the usable database for the MS model[5].

The MS model is solved in the following sequential manner. First, the labor supply is determined, then the household income is calculated. The resolution of the model consists in taking the prices of the CGE model after simulation and applying them to the endowments observed in the survey or those determined after simulation. It is important to note that the labor market is very rich in the model. We used econometric labor supply estimation information from Boccanfuso and Savard (2012) and information from the 2013-14 ECVMB survey to identify workers most vulnerable to layoffs in both labor markets and workers most likely to be hired in both labor markets. This allows us to capture the extensive margin of the labour supply (hiring or firing) following the application of a simulation in the CGE model. As an example, we used survey information on job vulnerability, desire to find a better job, availability for work, education,

[4] Note that although the original survey has 7092 households, we only retained households for which information was available in both the income and expenditure components.

[5] The data processing involves mapping nomenclature of the ECVMB survey to the nomenclature of the SAM.

and experience to classify workers and potential workers.

Once the labor changes applied, we use factor payments to compute new income level after simulation. We can then proceed to calculate household expenditures, taxes and savings. The final step in the microsimulation model is to compute changes in welfare for each household by using the equivalent variation (capturing the income and price effect of the simulation).

We also added a procedure in the resolution to capture the migration effects that are applied for one simulation. We calculated the number of households affected by migration based on the weight of households in the survey and the number of households in the survey. We then randomly drew households from each of the labor categories to have the simulated migrant equivalence in the CGE model. The randomly drawn households are then excluded from the sample for the distributional analysis[6].

3. Methodology for impact on social indicators and distributional analysis.

3.1 Impact on social indicators

In our social impact analysis, we use an original approach in the macro-micro context. The objective here is to extrapolate from the CGE model result what impact the political crisis and reduction of foreign aid could have in the medium to long term on five social indicators for children. Hence, we chose to exploit estimates of the relationship between changes in GDP/capita and levels of public spending on social services (health and education) and three health indicators and two schooling indicators for childre. To implement our impact analysis, we combine the macroeconomic results of our CGE model with these estimated elasticities drawn from the literature. Our CGE model allows us to capture the impact of the crisis on GDP and on variations in public spending. We are able to use these results with estimated elasticities for developing countries (mainly for African countries) to estimate potential impact on our selected social indicators. Several authors, *inter alia* Gupta et al (2002), Baldacci et al (2003) and Odhiambo et al (2015) estimated the relationship between different determinants such as (GDP, public expenditure, rurality, mothers' education, etc) and different social indicators[7]. It is obvious that this literature is more important for health and education indicators, as these two elements are considered central to human development. In the literature, the two most common indicators that are included in econometric estimates that target children are infant mortality indicators (U5) for health and school enrollment rates. We also found some estimates the relationship between the level of economic activity, public spending, and underweight, stunting and school perseverance rates (completing primary school). We will focus our impact analysis on these five

[6] We tested this randon draw ten times for robustness check for the distributional analysis and results wre not sensitive to the random draw.

[7] There is also a vast literature linking social spending on health and education on growth (*inter alia* Barro and Sala-i-Martin (1995) and Bloom and Canning (2003), Bloom et al (2004)).

indicators. This impact analysis will provide some insight into the medium-long term impact of the crisis and suspension of foreign aid. Note that we will also use observed data for GDP reduction and public expenditure in health and education during the crisis (for 2015 and 2016 period).

Most authors that analyse the relation between GDP and public expenditure and social indicators present a range of estimates using different estimation methods. For the purposes of our analysis, we have retained the lower bound values for the elasticities. There are two reasons for this choice: first, we believe that the upper bounds are quit high values and produce very strong results on social indicators that are probably more valid for very long-term situations. Second, the shocks experienced by Burundi are very strong and by associating them with high elasticity values, we obtain unrealistic results[8]. Without going into detail on the methodologies for estimating these elasticities, we can simply point out that some authors use time series but most authors, and more particularly for developing countries, use panels data.

The elasticity values (lower and upper bounds) that we have chosen are presented in Table 8 below.

Table 8: Elasticity values from the literature [9]

Indicators	Impact variables	Lower bound	Upper bound
Infant mortality (U5)	GDP + G_{health_public}	0,32	0,88
Stunting (U5)	GDP	0,05	0,08
Underweight (U5)	GDP	0,017	N/A
Net enrollment raten	GDP + $G_{education\_public}$	0,15	0,39
Academic perseverance (in the last year of elementary school)	GDP + $G_{education\_public}$	0,27	0,35

We therefore applied these elasticities (lower bounds) to the changes generated by the model for GDP and public expenditure and to changes observed and reported in UNICEF (2017a, 2017b, 2017c).

3.2 Distributional Analysis

To carry out the analysis of poverty and inequality, we use the empirical empirical approach as used in inter alia Cockburn (2002) and Boccanfuso and Savard (2007). For monetary poverty analysis, we use the standard FGT - Foster, Greer and Thorbecke (1984) decomposable poverty indices. As explained above,

[8] We have still done the calculations with the upper bounds and these results can be provided upon resquest.

[9] References used for these elasticities are Gupta et al (2002), Anyanwu and Erhijakpor (2007), Baldacci et al (2008), Yaqub et al (2012), Ruel et al (2013), Odhiambo et al (2015), Senadza and Hodey (2015), Mary (2018) and Mary et al (2019).

we capture the effects of change in household income but also the effects of change in the cost of the household consumption basket. The indices allow us to take into account the degree of aversion attributed to the poor. Thus, it is possible to measure changes in the depth of poverty with FGT1 and the severity for poverty with FGT2. For the distributional analysis, we use the Gini index as in Boccanfuso et al (2009) and Savard 2010.

3.1 Household categories

Since one of the objective of this paper is to analyse the impact of the Burundian crisis on children, we need to classify households in order to target this analysis. Given that we use households as the unit for distributional analysis, we have chosen a classification of households based on the type of children in the household. We classified children into three categories: those we would call "babies" from 0 to 23 months, then "children" from 2 years to less than 5 years and "other children" from 5 to 17 years. From this classification we created 8 categories of households, 4 categories based on the characteristics of the children and a decomposition according to the area of residence. The four categories are 1) households without children, 2) households with baby(s) 3) households with children (2 to - 5) and 4) households with other children (+5 to 17). Each of these groups was broken down into urban and rural areas. We thus have 8 categories of households.

Table 1: Household Breakdown

Houshold code	Household categories	Frequency	Share (%)
RWoInf	Rural households without children	589	8.8
UWoInf	Urban households without children	408	6.1
RLess2	Rural households with at lead one child below 2 years old	1433	21.4
ULess2	Urban households with at lead one child below 2 years old	617	9.2
R2to5	Rural households without child below 2 and at least one between 2 and 5	1384	20.7
U2to5	Urban households without child below 2 and at least one between 2 and 5	609	9.1
R5to17	Rural household without child below 5 and at least one between 5 and 17	1189	17.8
U5to17	Urban households without child below 5 and at least one between 5 and 17	452	6.8

4. Presentation of the scenarios

It is important to consider that simulations in the CGE model must be done on exogenous variables. It is important to take into account that several effects observed in the Burundian economy during the crisis starting in April 2015 will appear as an outcome of the scenario and therefore, it is not this outcome that is simulated in the model. It should also be kept in mind that the model used is a real economy CGE model. Hence, some monetary consequences cannot be analyzed with this model. In addition, the model incorporates elements of the informal sector such as the shift of workers from formal/skilled to informal, to

unemployment and vice versa. However, we do not have a shift of firms from one sector to the other[10].

It is also important to note that the shocks experienced by the Burundian economy were very strong. This situation has generated constraints in the design of the scenarios that we have implemented. First, we could reproduce the scale of the shocks as observed because their magnitude poses numerical resolution problems. As a result, the scenarios selected are of a smaller magnitude than what was observed. We also applied the scenarios in isolation in order to be able to decompose the transmission mechanisms and to be able to implement them in the models (given their large magnitude).

4.3 The selected scenarios

We chose to implement 4 simulations in our macro-micro analysis framework. The 4 simulations applied are summarized in Table 2 below and we describe each of the scenarios in the following section:

Tableau 2 : Scenarios applied to models

Name	Description
Sim 1	Reduction of foreign aid to the government by 20% and implementation of 15% tariffs in education, health and water
Sim 2	Reduction of foreign aid to the government by 20% and reduction of public spending by 15%.
Sim 3	External aid to the government decreases by 3% and total investment decreases by 10% with exogenous CAB, endogenous exchange rate and endogenous public spending
Sim 4	Emigration of 3.6% of workers outside the country (50% skilled and 50% unskilled)

Recall that the level of the simulations does not correspond to what is observed. In spite of this, we still carry out strong simulations from a modeling point of view. These simulations will allow us to have a good idea of a) the transmission mechanisms of these shocks to households (and children), b) the relative impacts between sectors and categories of households, and c) to identify the winners and losers of these shocks.

4.3.1 Decline in social services associated with decline in foreign aid (Sim 1).

This scenario aims to capture the effects of a decline in resources from the government or agencies responsible for providing health, education and water/sanitation services to citizens. Those responsible for providing these services have two choices when faced with a decline in resources: they can either increase

[10] For an example of this type of model, the reader can consult Fortin, Marceau and Savard (1997) where these authors constructed a CGE model with movement of firms from formal to informal and vice versa.

user fees to compensate for the lost revenue or they can reduce the provision of these services. With this scenario, we analyze the option of increasing rates for these basic services[11]. Given the specified consumption function, a part of the expenses for these services are fixed given the Stone Geary utility function (incompressible part) and therefore, households will suffer a large share of the increase in cost. For the other share, they can reduce their consumption, which will imply a decrease in demand and therefore in the supply of the sector (as well as employment).

Specifically, in this scenario, we decrease foreign aid to the government by 20% and increase tariffs on basic social services for health, education and water/sanitation. It should be noted here that the supply of drinking water is included in the "electricity-water-gas" (EWG) branch of activity, and therefore we are applying a smaller increase to this branch than to the other two branches, which are made up 100% of health and education services. We introduce a tariff that constitutes a 15% increase in the price of health and education services and a 5% increase for the EEG branch.

4.3.3 Reduction in public spending as a result of reduced foreign aid (Sim 2)

This second simulation consists of capturing the decline in the supply of public services as a whole, but more specifically the impact of the decline in supply on the labour market. Let us highlight that public services are produced by the government, consumed by the government and offered free of charge to the population according to the rules of national accounting. These services include public security, courts and all other services offered free of charge to the population. It is possible that some services, such as health and education, are highly subsidized but that tariffs are applied to users and that these services are accounted for in the market branches of the economy, which is the case for the national accounts in Burundi. However, there is also a share of health and education services that are consumed by the government as a public expenditure and the government offers this share free of charge to the population. Health and education services represent 35.4% of total public expenditure. The "government activity" share of 52% of public spending is not included into the household utility function and thus a decrease in this spending has no direct impact on household welfare (unlike in simulations 1)[12]. As a result, this simulation mainly captures the effects of this scenario on the labor market (and not the loss in welfare at the household level). This effect is not negligible because the public sector hires more than 84% of skilled workers, so the reduction in public services will have a significant impact on the welfare of workers who are affected by this major reduction

[11] We also ran the scenario of reducing the supply of these three services but did not present these results do to space constraints. These can be provided on demand.

[12] It is not included as we do not have the information on the free portion of health and education consumed by households in the survey.

in public spending.

In concrete terms, for this scenario, we simulate a decrease in foreign aid of 20% accompanied by a decrease in public spending of 15%. As mentioned, this simulation will have an important impact on the labor market with a decrease in the number of skilled workers and a strong decrease in wages for unskilled workers as skilled workers are pushed back into the unskilled (informal) market. In the model, we allow a share of the workers who are laid off to work in the informal sector as unskilled workers or to become unemployed while waiting for a skilled job later as in Bourguinon and Savard (2008).

4.3.4. Decline in investment in the economy (Sim 3)

For this scenario, we attempt to capture the effects of a decline in investment in the economy associated with the crisis. Here, the origin of the decline can come from several sources, either directly from the decline in foreign aid, or from the decline in agents' savings in the economy associated with the decline in economic activity or flight of savings out of the country. The first step in this simulation is to make investment exogenous so that it can be reduced. Since agents' savings are endogenous in the model, we must retain a new endogenous variable to balance savings with investment. We choose the public expenditure variable. This approach is the one proposed by Johanson at the end of the 1970s and commonly referred to as the Johanson closure (see Decaluwé et al 2001).

In concrete terms, the simulation consists of making investment exogenous and decreasing it by 10%. We accompany this drop in investment by a drop in foreign aid of 3%. Here, in order to capture the negative effects of the short-term mechanics, it is appropriate to make the current account balance (CAB) exogenous (otherwise the drop in foreign aid increases the level of investment and implies a very significant drop in the adjustment variable, which is public spending) and make the nominal exchange rate endogenous. Here, the adjustment or balancing variable of the government's budget constraint is public spending, and for the CAB, it is the nominal exchange rate that will adjust. Thus, public saving adjusts to balance the saving-investment constraint and public spending adjusts to balance the government's budget constraint.

4.3.5. Emigration out of Burundi (Sim 4)

The final scenario is an attempt to capture the impact of the high emigration out Burundi that occurred during the crisis. According data (in mid 2017) from UNHCR (2017b), there were 405201 Burundi refugees in neighboring countries that left after the onset of the crisis. Here, the objective is to analyze the impact of this migration on the economy. In general, there are several effects associated with migration. The decline in the labor force has an impact on the labor market but also on economic activity. In general, we observe a decline in economic activity following such a shock. In order to carry out this simulation, we have opted for the hypothesis that half of the workers leaving the country are skilled workers and the other half are unskilled. It is important to understand that given the oversupply of skilled workers in the economy, the

positions vacated by skilled workers will be filled by available workers. However, from a microeconomic perspective, migrant households will have an important impact on the distributional analysis because in the micro-simulation model, they are extracted from the labor market and the country.

In order to determine the percentage decline in workers to apply in the model, we used the ratio of Burundian workers to the population as a whole (World Bank 2017), which is 46.2%. Assuming that the ratio of workers in refugee households is the same as for the population as a whole, there would be 187201 fewer workers in the Burundian economy. This represents a 3.6 percent decline in the country's labor force. The simulation consists of reducing workers by 50% in the skilled and 50% in the unskilled markets. The main challenge in the design of this simulation is how to apply it in the MS model to reflect what we will apply in the CGE model. In order to determine the migrant households, as explained above, we randomly selected the migrant households.

5. Analysis of the results

5.1. Analysis of macroeconomic and sectoral results.

Given that the model contains 784 equations and endogenous variables, we cannot analyze all the effects of all the endogenous variables. In addition to about 15 macroeconomic variables, we focus on sectoral variables that have an important impact on household welfare, namely market prices and factor wages. It is important to note that households do not directly consume goods produced by the construction and mining industries and therefore changes in the market prices of these industries will not have a direct impact on household welfare. The goods most consumed by households are, in order, food agriculture, agri-food industries, other market services, other manufacturing industries and transportation. As a result, we will focus our analysis on these price variations. For factor payments, the key variables are the two wage rates and capital payment in agriculture and other market services sectors.

The first observation we can make, is that the scale of the results is rather large. The significant weight of foreign aid in the economy implies that important adjustments are made in order to regain equilibrium in markets that are constrained to equilibrium. For the labor market, it is not constrained to balance out and hence, simulations produce variations in the unemployment rate.

The macroeconomic results are presented in Table 3 below and the sectoral results in Tables 4 to 6.

Table 3 : Macroeconomic results (percentage changes)

Variables	Definition	Reference	Sim 1	Sim 2	Sim 3	Sim 4
w^1	Skilled wage (formal)	1	0	0	0	0
w^2	Unskilled wage (informal)	0.38	-10.5	-16.7	-5.1	5.9
Yhd	Houshold disposable income	3328.9	-0.4	-0.5	-0.1	-0.3
Sh	Household savings	- 339.9	-8.2	-7.5	10	-0.8
Yg	Government revenues	1129.0	-3.1	-8.4	-2.7	0
Sg	Public savings	290.3	-12.2	2.6	2.1	0
G	Public spending	683.7	0	-15	-5.3	0
Ye	Firms income	332.4	-1	-3.4	-1.3	0.1
Se	Firms savings	215.3	-1	-3.5	-1.3	0.1
OffNQ	Non qualified labour supply	459.6	5.8	9.5	2.2	-3.2
EmpQ	Qualified employment	562.3	-5.6	-9.1	-2.2	-0.3
Urate	Unemployment rate	0.10	4	6.5	1.6	0.9
CAB	Current account balance	500	19.1	19.1	0,0	-0.2
e	Nominal exchange rate	1	0	0	-7.4	0
IT	Total investment	681.7	12.6	17.6	-10	0.3
GDP	Gross domestic product	10155	-0.5	-0.9	-0.2	-0.3

* Calculations by the author

5.1.1 Simulation 1

Starting with the direct effects of the first simulation, we find that the CAB deficit increases substantially and the increase in tariffs for our three sectors is not enough to fully compensate for the loss of government revenue associated with the decline in foreign aid. The simulation generates a decline in overall economic activity of just over half a percent of GDP. This decline in economic activity is attributable to, among other things, an increase in the unemployment rate of 4%. The increase in unemployment is attributable to the decline in supply in the three social sectors that employ mainly skilled labor. A share of these workers become unemployed and the other share will find informal (unskilled) employment, causing the unskilled wage to fall by 10.5%. These labor market effects will have important welfare consequences for households affected by the loss of quality skilled jobs and the significant decline in unskilled wages. We also find that the incomes of the three main agents (household, business and government) decrease, which reduces savings in the economy. Total investment increases but this is due to the increase in the CAB deficit. The elements playing a key role in the impact on household welfare are wage rates and employment/unemployment.

At the sectoral level, we present changes in total employment by sector. These results are presented in Table 4 below.

Table 4: Sectoral results on aggregate employment by sector

Sectors	Reference	Sim 1	Sim 2	Sim 3	Sim 4
Food crops	8,00	12.4	23.7	7.8	-6.0
Export agriculture	39.3	14.0	24.0	-4.9	-5.8
Silviculture, forestry, related services	0.2	3.7	12.1	14.4	-6.2
Livestock and hunting	0.3	35.1	54.6	-7.7	-3.2
Fishing, fish farming, aquaculture	11.8	-0.9	-0.5	2.9	-0.5
Mining	1.1	29.9	49.5	-8	-6.5
Food industries	117.6	2.8	5.9	4.2	-1.8
Other manufacturing industries	19.6	4.9	7.1	-7.3	-1.5
Electricity, gas and water	20.5	-4.3	-1.9	3.6	-2.0
construction	32.8	28.3	43.3	-8.9	-3.0
Trade, repair of vehicles	10.8	9.7	17.8	-1.3	-5.0
Transport, auxiliary transport activities	49.4	1.9	5.1	-0.9	-1.9
Financial activities	72.6	-2.9	-1.5	9.0	-2.3
Other private services	16.6	-1.0	-6.8	4.7	-3.3
Public administration	190.5	1.3	-13.3	-3.5	-0.7
Education	226.4	-11.0	-11.5	-3.3	-0.2
Health and social services	109.1	-7.2	-6.3	-0.6	-0.4
Activities of a collective or personal nature	95.4	1.2	5.8	3.7	-1.6

* Calculations by the author

As mentioned above, there is a significant drop in employment in the three sectors directly affected by the increase in tariffs, with decreases of 11% in education, 7.2% in health and 4.3% in electricity, gas and water. Other sectors benefit from the significant drop in unskilled wages, as this significantly reduces their production costs. The main beneficiaries are the livestock sector, construction and the two agricultural branches. These sectors also benefit from the significant increase in investment linked to the increase in the CAB's deficit[13].

At the sectoral level, the decline in the three sectors is partly offset by an increase in production in the export agriculture (3.75%) and construction (3.47%) sectors. For the other sectors, the variations are modest, with changes of less than or around 1%. In terms of market prices (as shown in Table 5 below), there is a significant increase in prices in the three sectors directly affected by the tariff increase.

Table 5: Sector Results, Market Prices

[13] The unskilled wage is low and as a result, the percentage variations appear significant, but few workers are affected. The cases of livestock, forestry and mining are particularly affected by this situation.

Variables	Sectors	Reference	Sim 1	Sim 2	Sim 3	Sim 4
Pq	Food crops	1.00	1.5	4.1	0.8	-0.8
Pq	Export agriculture	1.00	-0.7	-1.8	-6.5	1.7
Pq	Silviculture, forestry, related services	1.01	-4.6	-3.7	6.2	-1.0
Pq	Livestock and hunting	1.01	8.0	12.6	-4.4	-0.4
Pq	Fishing, fish farming, aquaculture	1.01	-1.1	-1.5	-3.9	0.4
Pq	Mining	1.05	15.5	23.3	-11.9	-1.1
Pq	Food industries	1.12	-0.9	-0.6	-2.0	0.6
Pq	Other manufacturing industries	1.14	0.1	0.1	-6.8	0
Pq	Electricity, gas and water	1.07	4.5	-10.9	-3.3	2.5
Pq	construction	1.06	8.6	11.7	-8.8	0.7
Pq	Trade, repair of vehicles	1.00	1.9	3.6	-4	-1.2
Pq	Transport, auxiliary transport activities	1.08	-0.8	-1.2	-5.9	0.2
Pq	Financial activities	1.01	-4.6	-6.7	1	0.8
Pq	Other private services	1.01	-3.5	-8.7	0.6	-0.6
Pq	Public administration	1.00	-0.9	-5.5	-2.7	0.5
Pq	Education	1.00	14.6	-0.7	-0.4	0.1
Pq	Health and social services	1.00	14.6	-1.0	-1.0	0.2
Pq	Activities of a collective or personal nature	1.00	-1.3	-6.1	-3.8	1.6

* Calculations by the author

Prices for education and health increased by 14.6% and for the electricity, gas and water sector, the increase was 4.48%. The extractive industries (15.5%), construction (8.6%) and livestock (8%) are the other sectors experiencing significant increases. We observe the strongest price decreases in forestry (-4.6%), financial activities (-4.6%) and other private services (3.5%). These price changes will have important consequences on household welfare through changes in the cost of the consumption basket.

In terms of the return on capital, the food-producing agricultural sector benefits from an increase of 1.9% but the other services sector suffers a decrease of 5.1%. Workers of household active in these two sectors will experience opposite income effects[14].

Table 6: Sectoral value added

[14] Results of capital payment can be provided on demand.

Variables	Sectors	Reference	Sim 1	Sim 2	Sim 3	Sim 4
Va	Food crops	1287.0	0	0.1	0	0
Va	Export agriculture	73.6	3.8	6.2	-1.4	-1.7
Va	Silviculture, forestry, related services	31.7	0	0	0.1	0
Va	Livestock and hunting	50.0	0.1	0.2	0	0
Va	Fishing, fish farming, aquaculture	20.7	-0.3	-0.2	1.1	-0.2
Va	Mining	15.5	1	1.5	-0.3	-0.2
Va	Food industries	333.3	0.5	1.1	0.8	-0.3
Va	Other manufacturing industries	75.1	0.8	1.1	-1.2	-0.3
Va	Electricity, gas and water	33.7	-1.4	-0.6	1.1	-0.6
Va	construction	141.5	3.5	5	-1.3	-0.4
Va	Trade, repair of vehicles	187.1	0.4	0.8	-0.1	-0.2
Va	Transport, auxiliary transport activities	104.8	0.6	1.7	-0.3	-0.6
Va	Financial activities	119.0	-1.2	-0.7	3.8	-1
Va	Other private services	439.7	0	-0.2	0.1	-0.1
Va	Public administration	234.6	0.9	-9.5	-2.5	-0.5
Va	Education	227.9	-10.7	-11.3	-3.2	-0.1
Va	Health and social services	106.4	-7.2	-6.2	-0.6	-0.4
Va	Activities of a collective or personal nature	54.1	1.2	5.6	3.6	-1.5

* Calculations by the author

5.1.3 Simulation 2

For this scenario, the impact on skilled employment is very strong, with a drop of 9.1%. This decline contributes directly to the rise in the unemployment rate of 6.5% and the sharp decline in unskilled wages (-16.7%) as workers laid off from public sector jobs either become unemployed or work as unskilled workers at a much lower wage. This increase in the unemployment rate directly contributes to a reduction in economic activity with a decline in GDP of -0.9%. As the government sharply reduces its provision of public services, it manages to generate a small increase in public savings (2.6%). On the other hand, the other private agents of the economy saw their savings decrease substantially -7.5% for households and -3.5% for firms. The increase in the CAB deficit contributes to the increase in total investment.

At the sectoral level, as public expenditure is spread over several sectors, it is the sectors where public expenditure is most important that suffer the most in this scenario, namely the education sector (-11.3%), public administration activities (-9.5%), health (-6.2%) and to a lesser extent electricity, gas and water (-1.35%). The sectors that are increasing the most are export agriculture (6.2%), collective activity (5.6%) and construction (5%). The strongest price increases are in the extractive industries (23.3%) and construction (11.7%). However, as explained above, these goods are not consumed directly by households and therefore there will be no effect on household welfare. On the other hand, we observe a relatively strong increase in the livestock sector (12.6%) and food crops (4.1%), and these two goods are included in the household consumption basket. In this case, for the return on capital, it increases by 5.1% in food crops but decreases sharply in the "other private services" sector -13%. Hence, some households will be winners in

terms of income (farmers) but others will be big losers in the private service sector.

5.1.4 Simulation 3

This simulation produces different effects from other scenarios since total investment and the CAB are exogenous, so the adjustments occur through other variables, namely the nominal exchange rate, which is endogenous in this scenario. This appreciation is necessary to reduce exports and increase imports. As the scenario generates a downward adjustment of public spending (-5.3%), we have the dismissal of skilled workers (-2.2%) which will generate an increase in the unemployment rate of 1.6% and a decrease in unskilled wages (-5.1%). As foreign aid to the government is reduced by 3 percent and economic activity declines (GDP reduction of 0.2%t), the government sees its revenues decline by 2.7%. The adjustment in public savings to balance the savings-investment constraint is an increase of 2.1% because part of the adjustment is made through exchange rate appreciation that reduces the value of foreign savings (CAB) in domestic currency. Firms savings decreased by 1.3%. The decline in unskilled wage (-5.1%) and the decline in skilled employment will have a negative impact on the welfare of the households affected.

At the sectoral level, the sectors that grow the most are financial activities (+3.8%) and activities of collective nature (3.6%) and fishing (1.1%). The largest declines are in education (-3.2%), public administration (-2.5%) and export agriculture (-1.4%). The first two sectors were penalized by the 5.3% drop in public spending, and in the case of export agriculture, the appreciation of the exchange rate penalized this sector. As for market prices, we have the largest increases in the forestry (+6.2%), financial activities (+1%) and food crop (+0.8%). Market prices fell in 14 sectors with the largest decreases observed in manufacturing (-6.8%), export agriculture (-6.5%) and -5.9% for transport. We also observe an increase in the capital payment in the agricultural food sector (+2.9%) and other private services (+2.6%). The negative effects on unskilled wages and employment are likely to be partly offset by the fall in several prices and the increase in capital payments in the two key sectors for households.

5.1.5 Simulation 4

For this last scenario, we did not apply the decrease in foreign aid and therefore the results depend on other mechanisms, namely a withdrawal of labor from the economy. The two direct consequences of this simulation are a reduction in the supply of labor and consequently an increase in unskilled wages, but also a reduction in economic activity because there will be fewer workers in the economy. The GDP thus decreases by 0.3% following an exodus of 3.6% of the workforce. We see a small increase in the unemployment rate of 0.9 percent despite the fact that there are fewer workers available. This is explained by the decline in economic activity and the increase in the cost of unskilled labor, which contributes to a

reduction in the demand for labor in sectors that use unskilled labor intensively. Government and firms income are almost unchanged, but representative household income falls by 0.3%.

At the sectoral level, changes in output are all below 1% except for the export agriculture (-1.7%) and activities of collective nature (-1.5%) sectors. These two sectors have a large share of unskilled labor in their total value added and the increase in unskilled wages has a greater negative impact for these sectors. Price changes are more moderate in this scenario, with stronger positive changes in electricity, gas and water (+2.5%) and export agriculture (1.7%), and larger negative changes in trade and repair (-1.2%), mining (-1.1%) and forestry (-1%). For capital payment, the changes are also smaller, but the two important sectors (food crops and other private services) suffer declines of 1% and 1.1% respectively. The smaller changes in prices and capital payments should generate smaller welfare effects. However, this simulation has relatively large effects on the labor market (higher unemployment, lower skilled and unskilled employment).

5.2 Impact analysis on social indicators

We now move to the results and impact analysis on our five selected social indicated. Since the determinants of these indicators are multidimensional, the effects we present are likely to be a lower bound[15]. Let us recall that we retained two variables (public spending by social sector (health and education) and the change in the level of GDP/capita) affecting our social indicators since they are endogenous in the model. We also compute results from observed changes in these variables for Burundi for the years 2015 or 2016. It is important to keep in mind that the simulations we have carried out are done within an *ex ante* comparative static analysis framework. We do not attempt to reproduce all of the phenomena associated with the crisis, as this is a complex exercise and outside the scope of our paper. Hence, the calculations made with the results of the model should not be interpreted in relation to the calculations based on the observed data in the country. They allow to associate the portion of the total impact to the element simulated.

Data for observed changes in GDP/capita and public spending on health and education are from UNICEF 2017a, UNICEF 2017b, and UNICEF 2017c. In order to make our estimatsaves as close to reality as possible, we extrapolate our changes in GDP and public spending[16]. As such, we did not use our model-generated results directly but rather extrapolated results. The multiplicative factor used for extrapolation was 2.13 for the first twe simulations and 14.22 for the 3rd simulation. For the fifth simulation, we did not

[15] In addition to this, we used the lower bounds of elasticities found in the literature.

[16] As our simulation were partical, we extrapolate by assuming a linear relation and hence, it is a scaling of our results as if we would have simulated the complete observed reduction in foreign aid (and other variables simulated).

extrapolate because we did not simulate a decline in foreign aid but simply the impact of migration. The values used for changes in GDP/capita and changes in public expenditure in the social impact analysis are presented in Table 8 below:

Table 8: Changes Clin the factors affecting our social indicators in our analysis

Impact variables	Sim 1	Sim 2	Sim 3	Sim 4
	Simulated by the CGE model			
GDP	0.54	0.93	0.21	0.26
Health expenditure (public)	7.2	-6.23	0,00	-0.38
Public education expenditure	10.7	-11.31	0,00	-0.14
	Extrapolated to scale pu			
GDP	1.15	1.98	2.99	0.26
Health expenditure (public)	15.34	-13.27	0,00	-0.81
Public education expenditure	22.79	-24.09	0,00	-0.3

* Calculated by the authors and values taken from UNICEF (2017a), UNICEF (2017b), UNICEF (2017c)

The results from our impact analysis are presented in Table 9 below.

Table 9: Result of the impact analysis on social indicators *

Indicators	Baseline	Impact variables	Observed	Sim 1	Sim 2	Sim 3	Sim 4
Infant mortality (U5)	83/1000 (2013)	GDP + G_{health_public}	150.8	102.3	101.8	89.3	84.4
Stunting (U5)	56% (2016)	GDP	64.4	56.7	60.2	62.3	56.6
Underweight (U5)	28,8% (2012)	GDP	29.5	29	29.3	29.3	28.9
Net enrollment raten	96,5% (2014)	GDP + $G_{education\_public}$	92.2	94.7	94.5	N/A	96.5
Academic perseverance (in the last year of elementary school)	71,2% (2014)	GDP + $G_{education\_public}$	64.5	68.4	68.2	N/A	71.2

* Calculations by the author (N/A for not applicable because the expense is kept fixed in this simulation).

The value and base year of the social indicator is in the "baseline" column. For the infant mortality rate (U5), it was 83/1000 in 2013 (UNICEF 2017a), stunting, 56% (UNICEF 2017a), underweight 28,8% (Akombi 2017), the net enrollment rate was 96.5% in 2014 (UNICEF 2017b), and the school retention rate was 71.2% in 2014 (UNICEF 2017b).

5.2.1. Analysis of results on social indicators

Combining the impacts from changes in GDP and health expenditures generated by the model and on chold mortality ratio (U5), we observe an increases from 83/1000 to 102.3/1000 for the first simulation. The second simulation generates a slightly weaker impact (101.8 and the two others much more moderate effect (between 84 to 90). The effects are attenuated by the increase in health spending. The stunting rate is

much less sensitive with increases ranging from to 56.7% (Sim 1) to 62.3% (Sim 3) and the underweight rate increases from 29% to 2.39%. The net enrollment rate drops from 96.5% at baseline to a range of 94.5% (Sim 2)to 96.5% (Sim 4) and school retention drops from 71.2% to 68.4%. Finally, for school perseverance, the decreases goes from 71.2% (Sim 4) to 68.2% (Sim 2) It is important to consider that these indicators will vary with a lag of a few months or even years and at different rates for the health indicator and the education indicators.

When we compare our results from the model to the ones applied with observed data, as expected, we are below for all indicators but when added our effects from the model, we would come closer to what is computed with observed data. Moreover, in our simulations, we introduced additional shocks that mitigated the negative effects of the observed data. For example, in the case of simulation 1, we increased the tariffs for health care and education, and thus this alternative source of financing allowed the government to mitigate the reduction in supply in the social sectors in the model compared to what was observed in reality. These results highlight negative potential consequences of not maintaining the level of public spending at 2016 levels over a long period of time and the importance of have economic activity rebound in Burundi to prevent indicators from actually reaching the rates estimated in our analysis.

In summary, the impact analysis we have presented on the five social indicators illustrates the high sensitivity of these indicators to variations in the country's economic activity and the level of public spending. In the context where we have used the lower bounds of elasticity in the literature, the results obtained are all the more concerning. Since both impact factors (GDP/capita and public spending) are strongly negatively affected by the political crisis, the negative social consequences will be significant in the medium to long term, especially if the declines in the impact factors persist over time. The significant decline in GDP observed in 2016 has been lingering and the post-recession catch-up period to return to pre-crisis levels may take another 5 to 10 years depending on the extent of the economic recovery. Finally, we can reiterate that the dramatic cuts in public spending will have a very significant impact on the five social indicators analyzed, and the same will likely hold for other indicators that we have not been able to analyze due to the lack of elasticity available for impact analysis.

5.3 Social and distributional analysis

As explained above, social analysis consists of looking at the impact of shocks associated with the crisis in Burundi on household welfare. Our analytical framework, as we have mentioned, is the only one that allows to capture the negative/positive effects on household spending simultaneously with the effects on income by taking into account the interrelations in the economy of the simulated scenarios. In addition,

the analytical framework makes it possible to take into account the general equilibrium price effects on well-being. For example, the reduction in employment in social services has a negative impact on the reduction in consumption by households affected by job losses, but the layoff of workers also has effects on the labor market and on market prices in the economy. It is also important to recall that while we do not capture all the effects on household welfare, as we focus on monetary poverty in our distributive analysis. As a reminder, in the MS model, the elements that have an impact on the welfare of each household are: the two wage rates, 18 capital returns, the variation in labor endowment that occurs in the case of movement in labor markets and unemployment, and the 16 variations in prices of goods and services consumed by households. Thus, 38 variables affect idiosyncratically 6681 households. This poses a particular challenge in analyzing the results since we cannot simply explain how a poverty index evolves following the application of the scenarios because the index depends on the evolution of 38 variables for 6681 households[17]. In the analysis, we highlight the main effects that can explain the observed results.

5.2.1 Poverty analysis at baseline

Before presenting the results, we present the baseling distributional analysis. For this, we use the total expenditure of the survey data as the proxy of welfare for households. In addition, we chose a poverty line that allowed us to reproduce the official poverty data published by ISTEEBU (2015). Our reference point was therefore the national poverty headcount of 64.6%. The poverty line corresponding to this rate for the FGT0 index was 610,000 Francs burundais (BIF). This level is relatively close to that determined by ISTEEBU 635,510 BIF[18]. Applying this threshold to our household categories at the reference period, we summarize results in the following Table 10:

Table 10: Poverty and Inequality Profile at Baseline

Poverty and inequality profile at baseline				
Group	FGT0	FGT1	FGT2	Gini
National	0.646	0.265	0.137	0.694
RWoInf	0.517	0.193	0.096	0.574
UWoInf	0.126	0.036	0.016	0.864
RLess2	0.735	0.324	0.173	0.551
ULess2	0.288	0.101	0.05	0.706
R2to5	0.727	0.304	0.158	0.628
U2to5	0.277	0.098	0.048	0.770
R5to17	0.667	0.255	0.128	0.635
U5to17	0.175	0.063	0.031	0.565

* Calculations by the author

[17] In other words, there are a potential 253,878 items that vary after each simulation.

[18] Differences can come from different sources but after validation with the head of statistics of ISTEEBU, it was considered that the differences were likely due to the construction of our total expenditure vector.

For the headcount, we observe much higher rates in the rural area. The smallest gaps between the two zones are for households without children, with a gap of 39% points. For households with children, the differences are greater than 44% points. We also note that the highest poverty rate is for households with at least one baby under 2 years old (RLess2 with 73.5%), followed by households with at least one child under 5 years old (R2to5 with 72.7%). The group with the lowest rate is the urban household without children (UWoinf with 12.6%). We have exactly the same rankings with the other two FGT indices (depth and severity).

For inequality, the Gini index is very high at 0.694. At the subgroup level, it is quite common in developing countries to observe much lower levels of inequality in rural subgroup. Indeed, this is what we observe for three of the subgroups (rural-urban), but for households with children aged 5 to 17, inequality is higher in rural than in urban areas. The group with the highest inequality is urban households without children (USEnf) with a Gini index of 0.864.

5.2.2 Simulation 1

The distributional changes are presented in Table 11 below in percentage change compared to the baseline situation[19]. We start the poverty analysis with the headcount FGT0 index.

Table 11: Results for distributional analysis[20]

Results of the distributional analysis (% change from baseline)												
	Simulation 1			Simulation 2			Simulation 3			Simulation 4		
Group	Prop.	Sev.	Gini	Prop.	Sev.	Gini	Prop.	Sev.	Gini	Prop.	Sev.	Gini
National	-0.6	2.5	2.9	-2.7	0.7	0.7	-0.9	-0.6	2,0	-2.7	0.1	0.9
RWoInf	-1.2	8.4	3.5	-0.3	8.5	1.2	-0.5	3.1	1.8	6.4	21.3	4.9
UWoInf	2.3	-2.8	0.2	3,0	36.9	0.3	-2.7	-1.5	-0.1	8.3	57.3	1.3
RLess2	0.5	2.6	6.7	-1.2	-0.9	1,0	-0.5	-2.2	3.9	-3.6	-6.7	1.2
ULess2	-2.1	5.5	2,0	-0.1	8.9	0.5	-0.6	1.1	1.7	9.3	11.4	1.4
R2to5	-0.6	-0.4	6.1	-3.8	-2.9	0.9	-1.2	-2.2	5.4	-4.9	-3.5	0.5
U2to5	4.3	4.6	6.7	5.4	19.6	3.5	3.4	1.3	4.7	12.2	16.9	2.1
R5to17	-2.3	4.4	0.7	-5,0	3.8	2.2	-1.4	2.9	0.6	-4.3	6.9	4.4
U5to17	5.9	10.6	1.5	8.6	17.6	-0.4	0.9	10.6	2,0	18.1	27.7	1.5

* Calculations by the author

The first observation that emerges from these results is the highly differentiated effect from one type of household to another. At the national level, we observe a decrease in poverty of 0.6%, while the poverty rate increases for 4 categories of households, including a relatively large increase for households

[19] We don't present the FGT1 results as the trends are the same as for the severity index (FGT2). These results can be provided upon request to the author.

[20] The cells in green are the ones with a reduction in the indices.

U5to17 of 5.9% and households U2to5 of 4.3%. For their part, ULess2 households saw their poverty rate decrease by 2.3%. These negative effects in urban areas can be explained by the sharp decline in unskilled labor and the decline in the capital payment in more urban sectors (education, health, financial activity, transport and other private services). For this simulation, the capital payment in the agricultural and livestock sectors increased, and a majority of households in rural area derive their income from this source. The different consumption basket structure of urban and rural households also contributes to the different effects. Moreover, that workers negatively affected by job losses were probably more urban than rural households.

When we turn to the severity poverty index, its relevance is highlighted by our results. Thus for the severity of poverty, the positive effects observed for the poverty rate are reversed for three types of households and at the national level and for one household (UWoInf), the negative effect of FGT0 becomes positive. However, the strongest negative effect is always with the same group U5a17 and now at 10.6% higher. This indicates that despite the fact that we observe a lower number of poor for several groups, the poorest see their situation deteriorate in this scenario.

In terms of inequality, this simulation generates an increase in inequality at the national level of 2.9% and also for all household groups. The largest increase in the Gini index is for U2to5 (+6.7%) and RLess2 (+6.7%) and the smallest increases are observed for households UWoinf (+0.2%) and R2to17 (+0.7%). These results are probably due in part to the exogenous skilled labor wage and the sharp decline in unskilled wages. In addition, the price of crop agriculture increases by 1.5% and probably affects poorer households more negatively, as they consume more food in proportion than richer households. The prices that are decreasing (financial activities, other market services and transport) are probably more present in the consumption basket of richer households.

5.2.4 Simulation 2

Recall that this scenario consists of reducing external aid to the government with a reduction in public spending. It generated a drop in GDP of 0.9%, an increase in the unemployment rate of 1.8%, a significant drop in unskilled wages (-16.7%) but an increase in the return on agricultural capital of 5.1%. For this scenario, we observe a fairly strong decrease in the poverty rate at the national level of 2.7%.

This result is quite surprising but can be explained by the fact that a large number of households deriving their income from agricultural capital benefit from an increase in income and thus a large number benefit from the increase in the agriculture capital payment (+5.4% for export agriculture and 5.1% for crop agriculture). Unskilled workers are negatively affected but this does not seem to affect the FGT0 indices. For household groups, three urban households experience an increase in poverty: the urban household

without children (+3%), the U2to5 household (+5.4%) and the one with children aged 5 to 17 (+8.6%). The other groups benefit from a decrease in poverty for the FGT0 index.

Again, it is interesting to observe that when we move to the severity (FGT2) index, the situation is less favorable and we even have an increase in the FGT2 index at the national level by 0.7%. For all subgroups, there is also an increase in the index except for two groups of rural households with children (R2to5 -2.9% and RLess2 -0.9%). This simulation produces particularly negative results for urban households without children (UWoInf) and they are probably the most directly impacted by the decline in skilled employment observed here (-9.1%). Finally, this simulation produces increases in inequality at the national level (+0.7%) and for all household categories except for the U5to17 group (-0.4%). The largest increases in the Gini index are for the groups U2to5 (+3.5%) and R5to17 (+2.2%).

5.2.5 Simulation 3

For this simulation, we reduced investment in the economy with the decrease in foreign aid. Here again we cannot capture all the negative effects of such a simulation in a static model because the reduction in investment today will have negative impacts growth in the following years. Results must therefore be interpreted as a lower bound. The main features of this scenario are a decrease in GDP of 0.2%, a decrease in unskilled employment of 2.2%, an increase in unemployment of 1.6%, an increase in the return on crop agricultural capital of 2.9% and a decrease in unskilled wages of 5%. Finally, the prices of social services (health, education and water) decreased slightly. For this scenario, we observe a decrease in the poverty rate at the national level of 0.9%.

As with the other simulations, looking only at the poverty rate index would give the impression of a rather positive scenario, since poverty decreases for six of the eight household groups, with increases only for two urban groups (U2to5 +3.4 and U5to17 +0.9%). The largest decrease in the poverty rate is observed for urban households without children (-2.7%). However, the results of the severity index are less favorable for most households while the situation remains positive at the national level (-0.6%). For three groups of households (UWoInf, RLess2 and R2to5), the situation remains positive with a respective reduction in severity index of -1.5%, -2.2% and -2.2%. This simulation is the least unfavorable for households with young children, especially in rural areas. On the other hand, inequalities increase both at the national level (+2%) and for all household groups, with the exception of the group of urban households without children (a slight decrease to -0.1%). We observe strong increases in inequality for the R2to5 (+5.4%), U2to5 (+4.7%) and RLess2 (+3.9%) groups. It is therefore 3 of the 4 groups of households with young children that are most negatively affected in terms of inequality increases.

5.2.6 Simulation 4

The fourth scenario is different from others insofar as we do not reduce external aid but simulate the impact of emigration. Here the bulk of the effects comes from the impact on the labor market and the general equilibrium effects on prices caused by this shock. The main results are that GDP falls by 0.3%, skilled employment falls by 0.3% and unskilled by 3.2%. However, there is an increase in unskilled wages of almost 6%. In terms of prices, there is a decrease in crop agriculture but an increase in the social sectors. Finally, the 1% decrease in the crop agricultural and 0.8% in export agriculture capital payments will have a negative impact on many rural households. For this scenario, we observe a decrease in the poverty rate at the national level of 2.7%.

Here, it should be emphasized that the poverty analysis is performed on the population that remains in the country after the shock. Thus, migrants who leave the country are excluded from the analysis. It is interesting to observe that this simulation has a rather different impact in rural and urban areas. Rural households all benefit from a significant decrease in poverty, except for the group without children (+6.4%), while urban households experience significant increases in poverty. For urban households, the group without children has the smallest negative impact and the group with children aged 5 to 17 has the largest impact. For the severity index (FGT2), we now have an increase in the index at the national level and only RLess2 and R2to5 households benefit from a decrease in poverty with respective decreases of 6.7% and 3.5%. This simulation produces fairly clear distributional results with an increase in inequality at the national level of 0.9% and for all groups. The largest increase in inequality is for rural households without children (+4.9%) followed by rural households with children aged 5-17 (+4.4%).

6. Conclusions

The objective of this paper was to analyze the socio-economic impacts of the crisis in Burundi using a CGE model associated with a MS model. This is the first application of this macro-micro framework in Burundi. Moreover, we extend from the existing macro-micro literature by using our model results and real data observed with the elasticities from the literature to estimate the impact of the crisis on five social indicators. In designing our scenarios, we have tried to capture the main features of the political crisis, namely, reduction in external aid, reduction in the supply of social services (education, health, water, etc.), reduction in the quality of social services, increase in the price of these services, impact on investment and migration. We applied various effects of the crisis in isolation in each scenario in order to isolate and understand the contribution of each of the phenomena in the final results obtained.

The results of our scenarios show a very negative trend on most macroeconomic variables (GDP, unemployment, salaried employment), price increases and reduction of supply in social services. However,

on the level of unskilled wages, remuneration of agricultural capital and other market services, and the prices of goods, the effects are sometimes positive and these elements sometimes compensate for some of the negative direct consequences of the scenarios. For example, migration contributes to an increase in unskilled wages and the return on crop agricultural capital increases in three out of four scenarios.

The social impact analysis conducted with the model results and the actual data observed on our five social indicators show relatively strong negative impacts. This highlights the fact that poor households with kids are vulnerable to suspension of aid and other manifestations of the political crisis. It also highlights the importance of reviving economic activity in the country and increasing public social spending as quickly as possible in order to avoid a rapid deterioration of these social indicators. A persistent recession and public budget cuts in the social sectors could cause the indicators to change very quickly, and the longer the recovery period, the longer it will take to recover the pre-crisis level of indicators. As for the distributional analysis, the scenarios applied tend to produce negative effects on income distribution but for poverty, we observe reductions in headcount poverty index for all scenarios at the national level and for most subgroups. For severity, poverty increase for three out of four scenarios at the national level and for the majority of the subgroups (23 subgroups out of 32). In general, rural households seem to be less negatively affected and households with younger children experience the strongest negative effects. In most cases, it is rural households that suffer the strongest negative effects of the crisis-related shocks. Finally, we find more negative results with the use of severity of poverty that assigns more weight to poorest households.

In view of these results, and as explained above, the medium- and long-term consequences will be even more dramatic, the support to social sectors is crucial to preclude exposing poor children from the crisis. Rural households with children have extremely high poverty rates even before the crisis (from 67% to 74%) and therefore, a prolongation of the negative effects of the crisis on these populations could both increase the vulnerability of these families. It is essential to either redirect funding to these priority services for the welfare of these households and especially their children or find a way to bring in external aid again to restore funding to pre-crisis levels, although the damage from the crisis may create a greater need than the pre-crisis levels of aid.

6. References

Akombi, B.J., K.E. Agho, D. Merom, A.M. Renzano and J.J. Hall (2017), Child Malnutrition in sub-Saharan Africa A meta-analysis of demographic and health serveys (2006-2016), PloS One, 12(5) pp. e0177338.

Anyanwu, J. C. and Erhijakpor, A. E. O. (2007), Health Expenditures and Health Outcomes in *Africa, Economic Research Working Paper, No 91, Nairobi, Kenya.*

Baldacci, E., Clements, B., Gupta, S. and Cui, Q. (2008), Social Spending, Human Capital and Growth in Developing Countries, *World Development*, 38(8), pp. 1317-1341.

Barro, R., & Sala-i-Martin, X. (1995). *Economic growth*. New York: McGraw-Hill.

Bloom, D., and D. Canning, D. (2003). The health and poverty of nations: From theory to practice. *Journal of Human Development*, 4(1), pp. 47–71.

Bloom, D., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development*, 32(1), 1–13.

Boccanfuso, D. and L. Savard, (2007) Impacts Analysis of Cotton Subsidies on Poverty: A CGE Macro-Accounting Approach, *Journal of African Economies.* 16(4), pp. 629-659.

Boccanfuso, D., A. Estache and L. Savard, (2009), Electricity reforms in Mali: a macro–micro analysis of the effects on poverty and distribution, South African Journal of Economics 77 (1), pp. 127-147.

Boccanfuso, D. and L. Savard, (2012), A Segmented Labour Supply Model Estimation for the Construction of a CGE Micro-simulation Model: An Application to the Philippines, *The Journal of Applied Economic Research* 6(2): 211-234.

Boccanfuso, D., M. Coulibaly, L. Savard and G. Timilsina (2018), Macroeconomic and Distributional Impact of Jatropha based Biodiesel in Mali, *Economies*, 6(4), pp. 1-22.

Boshoff, H., W. Vrey, and G. Rautenbach. (2010), The Burundi Peace Process. From Civil War to Conditional Peace, Monograph 171. Pretoria: Institute of Security Studies (ISS) .

Bourguignon, F. and A. Spadaro (2003), Les modèles de microsimulation dans l'analyse des politiques de redistribution : une brève présentation, *Économie et Prévision*, 160(4), pp. 231-238.

Bourguignon, F., and L. Savard. (2008), A CGE Integrated Multi-Household Model with Segmented Labor Markets and unemployment in Bourguignon, F., L.A. Pereira da Silva and M. Bussolo, eds. "*The Impact of Macroeconomic Policies on Poverty and Income Distribution: Macro-Micro Evaluation Techniques and Tools*" Palgrave-Macmillan Publishers Limited, Houndmills.

Chia N-C, Wahba S, and J. Whalley (1994), Poverty-reduction targeting programs: A general equilibrium approach. *Journal of African Economies*, 3(2), pp. 309-338.

Central Intelligence Agency (2017). https://www.cia.gov/library/publications/the-world-factbook/geos/by.html. Consulted on 2017-06-09.

Cockburn , J., (2002) Trade Liberalisation and Poverty in Nepal: A Computable General Equilibrium Micro Simulation Analysis, Working paper 2002-11, Centre for the Study of African Economies (Oxford

University).

Cockburn, J., Savard, L. and L. Tiberti, (2014), Macro-Micro Models in C. O'Donoghue (ed.), Handbook of Microsimulation Modelling (Contributions to Economic Analysis, Volume 293), Emerald Group Publishing Ltd. Bingley, U.K..V., pp. 275-304.

Cockburn, J. H. Maisonnave, V. Robichaud and L. Tiberti, (2016). "Fiscal Space and Public Spending on Children in Burkina Faso," International Journal of Microsimulation, 9(1), pp. 5-23.

Deloitte (2016). Burundi Economic Outlook 2016: The Story Behind the Numbers Forum pour le Renforcement de la Société Civile (FPRSC), Impacts of the political and economic crisis on education in Burundi. Special Report.

Decaluwé B., Patry, A. Savard, L. and E. Thorbecke (1999) Poverty analysis within a general equilibrium framework. Working paper, African economic research consortium, 1999, n° 99-09, Nairobi.

Decaluwé B., Dumont J.-C., and L. Savard (1999) How to measure poverty and inequality in general equilibrium framework. Cahier de recherche, CREFA, Université Laval, 1999, n°99-20, Québec.

Decaluwé, B., A. Martens, and L. Savard « La politique économique du développement et les modèles d'équilibre général calculable ». Presses de l'Université de Montréal collection AUF, Septembre 2001.

de Janvry A., Sadoulet E., and A. Fargeix (1991), *Adjustment and equity in Ecuador*, Paris: Centre de Développement de l'OCDE.

De Quatrebarbes, C., D. Boccanfuso, L. Savard (2016). Beyond representative households: the macro-micro impact analysis of VAT designs applied to Niger. *Economic Modelling*, 57, pp. 76-92

Fortin, B., N. Marceau and L. Savard, (1997) "Taxation, Wage Controls, and the Informal Sector: An Applied General Equilibrium Approach", *Journal of Public Economics* 66(2), pp. 293-312.

Forum pour le Renforcement de la Société Civile -FPRSC (2017), Impacts of the political and economic crisis on education in Burundi. Special Report, mars 2017.

Foster J., Greer J., and E. Thorbecke (1984), A class of decomposable poverty measures. *Econometrica*, 1984, 52(3) pp. 761-766.

Furman, J. (2006), Tax Reform and Poverty, Center on Budget and Policy Priorities, Washington, DC.

Gupta, S., Verhoeven, M., and Tiongson, E., (2002), The effectiveness of government spending on education and health care in developing and transition economies, *European Journal of Political Economy*, 18(4), pp. 717-737.

Huppi M., and M. Ravallion (1991), The sectoral structure of poverty during an adjustment period: Evidence for Indonesia in the mid-1980's. *World Development* 19(12) pp.1653-1678.

Institut de Statistiques et d'Études Économiques du Burundi- ISTEEBU (2015), Burundi : Profil et déterminants de la pauvreté, Rapport de l'enquête modulaire sur les condition de vie des ménages 2013/2014, Bujumbura.

Institut de relations internationales et stratégiques- IRIS (2016), Crisis in Burundi: A Three-Year Outlook

for the Region 2016-2019, Humanitarian Foresight Think Tank, Septembre 2016.

International Organization for Migration-IOM (2017), DTM-IOM Displacement Tracking Matrix : Burnundi.
Le Monde. (2017) http://www.lemonde.fr/afrique/article/2016/03/14/l-ue-suspend-son-aide-directe-au-gouvernement-burundais_4882379_3212.html. Consulted on 2017-06-09.

Mary, S. (2018), How Much Does Economic Growth Contribute to Child Stunting Reductions? *Economies*, 2018, 6(4):55. https://doi.org/10.3390/economies6040055.

Mary, S. K. Shaw and S. Gomez y Paloma, (2019). "Does the sectoral composition of growth affect child stunting reductions?," *Development Policy Review*, 37(2), pp. 225-244.

Odhiambo SA, Wambugu A, et Kiriti-Nganga T. (2015) Effect of Health Expenditure on Child Health in Sub-Saharan Africa: Governance Perspective. *Journal of Economics and Sustainable Development*. 6(8), pp. 24-65.

OECD -African Economic Outlook 2016: Sustainable Cities and Structural Transformation, Chapter: How Sustainable Cities Can Contribute to Africa's Development, Publisher: OECD Publishing, Editors: OECD.

RFI Afrique, Crise au Burundi: le Conseil de sécurité de l'ONU rencontre l'UA. http://www.rfi.fr/afrique/20160123-crise-burundi-ONU-union-africaine-politique-nkurunziza. 2017-06-09.

Robichaud, V., H. Maisonnave, L. Tiberti, (2014) Impact of Increased Public Education Spending on Growth and Poverty in Uganda: An Integrated Micro-Macro Approach (January 1, 2014). PEP working paper series 2014-01,

Ruel, M. T., H. Alderman, and Maternal and Child Nutrition Study Group. (2013). Nutrition- sensitive interventions and programmes: How can they help to accelerate progress in improving maternal and child nutrition? *The Lancet* 382 (9891): pp. 536–551.

Savard, L. (2005), "Poverty and inequality analysis within a CGE Framework: a comparative analysis of the representative agent and microsimulation approaches", *Development Policy Review*, 23(3), 313-332.

Savard, L. (2010) Scaling up Infrastructure Spending in the Philippines : A top-down bottom up micro-simulation approach, *International Journal of Microsimulation.* 3(1), pp. 43-59.

Savard, L. (2016), Rapport sur la construction de la Matrice de Comptabilité Sociale du Burundi. Projet pour le Renforcement des capacités institutionnelles pour l'efficacité gouvernementale, Ministère des finances, du Budget et de la Planification économique, Bujumbura.

Senadza, B. and L. S. Hodey (2015), Effect of Public Education expenditure on selected primary education outcomes in Sub-Saharan Africa, International Journal of Education Economics and Development, 6(4), pp. 314-330.

Sindu K. W., B. Fekadu and D. Aredo, (2016). "Impact of Trade Liberalization on Poverty in Ethiopia: A Computable General Equilibrium Microsimulation," *International Journal of Microsimulation*, vol. 9(1), pages 109-133.

UNICEF (2017a), Budget Brief : The 2017 Health Sector Budget-Burundi.

UNICEF (2017a), Budget Brief : The 2017 Education Sector Budget-Burundi.

UNICEF (2017c), Budget Brief : The 2017 State Budget-Burundi.

United Nation Development Program-UNDP (2016), Human Development Report 2016 : Human Development for Everyone, New York.

United Nation Development Program-UNDP (2019), Human Development Report 2019: Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century, New York.

United Nation Human Rights Council-UNHRC (2017a), Burundi Situation: UNHCR Regional Update no 35, New York.

United Nation Human Rights Council-UNHRC (2017b), http://data2.unhcr.org/en/situations/burundi. Consulted on 2017-06-09.

Wodon, Q. and H. Zaman (2010), Higher Food Prices in Sub-Saharan Africa : Poverty Impact and Policy Responses, *The World Bank Research Observer*, 25(1), pp. 157-176.

World Bank. (2022) "GDP growth (annual %) - Burundi" *World Development Indicators*. The World Bank Group, data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=BI. Accessed 28 June 2022.

Yaqub, J.O., Ojapinwa, T.V and R.O. Yussuff, (2012), Public Health Expenditure and health outcome in Nigeria: the impact of governance, *European Scientific Journal*, 8(13), pp. 189-201.