Economic Costs of Civil Conflicts: The Case of Burundi

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Abstract

This study examines the effects of episodes of civil conflicts in Burundi on its economic performance. We use four different estimation methods: regression method using Extreme Bound Analysis, Synthetic Control method, filtering techniques and a simple OLS trend method. Our main results indicate that: (1) from 1970 to 2015 civil conflicts on average reduced economic growth by 4 percentage points per year of conflict; (2) the 1993 – 2003 civil war cost each Burundian between USD 1290 and USD 1520 and between USD 8 billion and USD 10 billion to the whole country; (3) the last civil conflict in 2015 has been relatively costly, having reduced the economic growth by 8.9 percentage points relative to its counterfactual. These results highlight the need to consolidate peace in order to eliminate fragility and achieve long-term economic development in Burundi.

Keywords: Conflicts; Fragility; GDP growth; GDP cost; Burundi; Extreme Bound Analysis; Synthetic Control Method; Hamilton filter

JEL Classification: C22, C99, E00, O47

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1. Introduction

Generally known for its history of political instability and civil conflicts, Burundi is a small East African country, roughly the size of Belgium, the former colonizer, from which it gained independence in 1962. It has a population size of approximately 11 million people. Its GDP per capita, estimated at USD 800 (PPP) in 2018, place the country among the poorest in the world. Although Burundians share the same language, the same culture and live side by side in different regions, it is commonly admitted that they are divided into three ethnic groups: 85% of Hutus, 14% of Tutsis and 1% of Twas, despite the fact that the last ethnic affiliation census dates back to colonial times.

Since its independence in 1962, the country has experienced six episodes of civil conflicts respectively in 1965, 1972, 1988, 1991, 1993-2013 and 2015. Apart from the last conflict which was fuelled by a wide-ranging opposition to a third term of the current president of Burundi, the other conflicts were typically triggered by a localized Hutu insurrection in which Tutsis were killed, followed with a disproportionate and indiscriminate military repression of the Hutu population. Some scholars have attributed the recurrent Hutu insurgencies to an ethno-racism against the Tutsis minority, notably the historian and Great Lakes Region specialist Jean Pierre Chrétien (See Chrétien, 2000, Chap. V), while for others, the deep cause of the violence was the political and economic exclusion of the Hutu majority (Ndikumana, 2000; Ngaruko and Nkurunziza, 2000). There is however a consensus that politicians on both sides have utilized ethnicity for their personal interest.

Over the last 54 years, the economy of Burundi grew on average at 2.6% a year. Despite political instabilities and civil unrests in the 1960s and 1970s, the economy managed to grow moderately. While in the 1970s the economy of Burundi was growing at a similar rate as an average Sub-Saharan African country, in the 1980s, economic growth of Burundi was 4.2%, almost the triple of the average for sub-Saharan Africa (1.4%) [See Tables A.4 and A.5 in the Appendix]. However, with the 1993 civil war, the trend reversed. Today, Burundi is one of the poorest countries in the world with one of the lowest human development. Like many

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3 Source: World Economic Outlook database (IMF)
4 1956 estimates show the following ethnic composition: 86.48% Hutus, 12.39% Tutsis and 1.3% Twas (Reyntjens, 1993).
5 The poverty headcount ratio ($1.25 a day) was 84.24% in 1992, 86.43% in 1998 and 81.32% in 2006 (WDI, 2017).
other post-conflicts countries, Burundi is classified as a fragile\(^7\) state by the World Bank with a CPIA\(^8\) score in 2015 of 3.1.

Few studies have sought to examine the economic performance of Burundi (see for example, Nganou et al., 2007; Nkurunziza and Ngaruko, 2008; Basdevant, 2011; Nganou and Kebede, 2012). However, the aim of these studies was not to examine the impact of civil conflicts on economic performance but more of analyzing the determinants of economic growth. Thus, the impact of civil conflicts remains unknown since it has not yet been a specific subject of interest.

This study fills this gap in the literature by examining the impact or cost of civil conflicts in four different ways. First, we examined the impact of civil conflicts on economic growth using a regression method involving Extreme Bound Analysis in order to address specification uncertainty as well as obtain upper and lower limits of the impact of war. This approach provides an average effect of all the civil conflicts that Burundi has experienced from independence till 2015. Second, we applied the synthetic control method to quantify the economic cost of the 1993-2003 civil war, that is the loss of GDP per capita due to the war. This method takes into account the likely path of the Burundian economy in the absence of the conflict. We focus on the 1993 civil war since it lasted for a decade and was more devastating than the previous episodes which were short-lived. Moreover, before 1993, despite political instabilities and episodes of civil unrests, GDP per capita was following an upward trend up to 1992. Our third method calculates potential GDP growth using different filtering techniques: the Hamilton, the Hodrick–Prescott and the Baxter-King filters. We finish the analysis with a simple Ordinary Least Squares (OLS) estimation of the trend before conflict.

Hence, this study estimates the GDP cost of the civil conflicts that Burundi has experienced from 1970 to 2015, paying particular attention the 1993 - 2003 civil war and the effect of the recent 2015 conflict. The estimated costs are substantial. They should raise awareness on the importance of avoiding conflicts, which are major sources of fragility. They should in

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\(^6\) According to the Human Development Index, Burundi ranked 178 out of 186 in 2012, and 180 out of 187 countries in 2013. In 2015, it ranked 184/188 with a HDI index of 0.404.

\(^7\) The World Bank classifies a country as fragile if it has either a harmonized average\(^7\) CPIA score which is less or equal to 3.2, or if it has had a UN and/or regional peace-keeping or peace-building mission during the past three years.

\(^8\) The World Bank CPIA (Country Policy and Institutional Assessment) index includes 16 criteria grouped into four clusters, namely economic management, structural policies, policies for social inclusion/equity and public sector management and institutions.
particular speak to Burundian policymakers, too often immune to the adverse effects of conflicts.

The rest of the paper is organized as follows. Section 2 discusses in further details the evolution of the Burundian economy from independence till 2015. Sections 3 and 4 present the theoretical framework and the review of the literature on the economic consequences of conflicts. Section 5 details our various estimation methods. In Section 6 we present results from different estimation methods along with robustness checks. We summarize our findings in Section 7 and conclude in Section 8.

2. Burundian Economic Performance since Independence

We analyze the economic growth patterns of Burundi over five periods of time according to episodes of civil conflicts that were experienced. The following categories of periods are considered; from 1961 to 1972, from 1973 to 1992, from 1993 to 1999, from 2000 to 2004, and from 2005 to 2015. The period of 1961-1972 was a period of high political tensions. In October 1961, Prince Louis Rwagasore, the independence hero of Burundi, was assassinated. As Nkurunziza and Ngaruko (2003) argue, Prince Louis Rwagasore had instilled unity among Burundians and after his assassination, political fights began among political elites. This resulted in a number of political assassinations and civil conflicts in 1965, 1969 and 1972. However, despite continuing political tensions and sporadic conflicts, the economy managed to grow on average at 3.7 percent while real per capita GDP grew at 1.6% per year during that period. It is to be noted that during 1961-1972, Burundi’s economy contracted four times, that is, in 1961 by 13.7%, in 1968 by 0.3%, in 1969 by 1.5%, and in 1972 by 6.4%, mainly due to civil unrests which claimed thousands of people’s lives and caused massive displacements, which in turn lowered agriculture value-added and productivity in other sectors (Nguessa-Nagnou et al., 2007). In contrast, the period 1973-1992 was characterized by less political tensions and relative calm a part from the year 1988 where civil conflicts occurred in northern of Burundi. In that period, real GDP grew on average at 4% while per capita GDP grew at 1.4% per annum. As Nkurunziza and Ngaruko (2003) and Nguessa-Nagnou et al. (2007) indicate, growth performance in this period was due to massive investment programmes which were undertaken from 1975, financed mostly by foreign resources. While the annual investment ratio stood only at 6.2% during the period 1960-1974, it more than doubled during the period 1975-1992, standing on average at 14.6% (Figure 1). However, this was also a period of economic difficulties caused by high budget deficits and high debt servicing. As for the period 1993-1999, this is the most chaotic period in the
Burundian history. After almost 3 decades of military dictatorial regimes (1966-1993), Burundi had the first democratically elected president, Melchior Ndadaye, in 1993, whom was killed three months later in a military coup. As a consequence, a civil war erupted and lasted for about a decade. The civil war claimed thousands of lives while many others fled the country or became internally displaced. From 1995, the attacks of rebel groups intensified and the situation was aggravated by an economic embargo which was imposed on Burundi by the international community after another military coup in July 1996. The economic embargo went up to 2001. As a consequence, Burundi’s economy contracted sharply during that period, recording a positive economic growth only once, that is, in 1998. Also, during this period, investment fell dramatically, hitting a record low of 3 % in 2000, down from average of 16% in the decade before the civil war.

Figure 1: GDP per capita (left scale), Investment (right scale) and Inflation from (right scale) 1967 to 2015.

The period of 2000-2004 is the transition period in which peace talks were held and peace agreements signed. The events followed as follows: Arusha peace agreement was signed in August 2000, in November 2001, a transition government was formed, and in November 2003, a seize-fire agreement was signed between the government and the major rebel group (CNDD-FDD). External aid which had stopped in the previous years due to economic

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9 From 1982 to 1991. Note that investment started to fall in 1992, one year before the beginning of the civil war, reflecting investors’ anticipation of the crisis.
embargo resumed in this period (Figure 2). Also, the government carried out a number of policy reforms for economic recovery, which were supported by the World Bank. During this period, despite the relative calm, the economy did not grow much. However, compared to the previous period (1993-1999), the economy recovered a little bit (1.9%) but per capita GDP growth remained negative (-1.1%). The weak recovery in this period was also due to some prolonged droughts that started in 1999 and continued in 2000 and caused the agriculture value added to fall by 5.2% (Figure 2).

**Figure 2: Official Development Assistance (left scale) and Agriculture Value Added (right scale) 1970 to 2015**

The last period we consider is 2005-2015, which is the post-conflict period. After the peace agreement between the government and the major rebel group (CNDD-FDD) in November 2003, violence in the country reduced drastically. The peace agreement with the last rebel group (FNL) was secured in May 2008. Therefore, between November 2003 and May 2008, there was still some sporadic violence in some parts of the country, especially in the area around the capital city Bujumbura. It is to be noted that, unlike other post-conflict countries (for example, Mozambique, Rwanda, and Sierra Leone) that recorded high economic growth rates after the conflicts, Burundi did not reap the peace dividend as the economy grew on average only at 3.4% per annum during the period 2005-2015 while per capita GDP fell by
0.1%. Poor growth performance was due to high corruption and poor governance which characterized the ruling elites in that period.

Also, massive violation of human rights and opposition repression characterized that period. In addition, a number of financial scandals and embezzlements of public funds were reported by the media and the anti-corruption observatory. It is to be noted that, while from 2006 to 2014, the economy managed to grow at 4% on average, in the year 2015, the economy contracted by 3.9% due to civil unrests that started in April 2015 and lasted for many months.

The above analysis suggests that Burundi is capable of attaining good economic performance as its economic performance before 1993 shows. In addition, although some other factors such as corruption, poor governance, etc., might have caused the sluggish economic performance, civil conflicts, in particular the 1993 – 2003 civil war, seem to have had a detrimental impact on economic performance of Burundi.

3. Theoretical Framework

Although this paper is concerned with the way the economy is affected during conflict (and not in the long run), this theoretical framework starts with long run growth models in order to provide useful insights onto how the economy might be affected in the short term.

Two mainstream strands of literature are found on the factors determining economic performance in the long run: the neoclassical theory of exogenous growth formalized by Solow (1956) and the theory of endogenous growth, pioneered by Romer (1986, 1990), Lucas (1988), and Barro (1990).

According to the Solow growth model, changes in the investment rate and the population growth rate affect the long-run level of output per worker, but do not affect its long-run growth rate. The neoclassical Solow model shows that in the long term, the growth rate of output per worker depends on the rate of labour-augmenting improvement in technology, which is exogenous to the model. The model implies that permanent differences in countries’ productivity levels are caused by faster/slower population growth or a higher/lower savings rate. Therefore, in the Solow model, technological progress, which is exogenous, is the only engine of growth. Policy changes can have level effects but do not have long-run growth effects.
On the other hand, the theory of endogenous growth, pioneered by Romer (1986, 1990) and Lucas (1988) put emphasis on human capital and innovation capacity. According to endogenous growth theory, economic growth is the result of endogenous factors; investment in human capital, innovation, and knowledge are significant contributors to economic growth. The endogenous growth theory also focuses on positive externalities and spillover effects of a knowledge-based economy which will lead to economic development.

The simplest endogenous growth model is the AK model, where output is a linear function of capital. The model assumes constant exogenous saving rate and fixed level of technology. Unlike the Solow model, AK model does not include diminishing returns to capital, rather capital accumulation is the source of increasing returns. In the AK model, the growth rate of output is increasing in the saving rate. Capital accumulation could act as the engine of sustained economic growth. Other endogenous growth models that built on AK model developed by Romer (1986), Lucas (1988), Barro (1990), etc., have drawn attention to human capital and innovation capacity.

Romer (1986) developed an AK model with inter-temporal consumer maximization with the idea that productivity could increase as the result of learning-by-doing externalities. The model looks at investment in education, R&D etc. as the source of technical change. Lucas (1988) developed an AK model where the creation and transmission of knowledge occurs through human capital accumulation. Rebelo (1991) use the AK model to analyze the effect of fiscal policy on growth. Jones, Manuelli and Stachetti (1999) use again the AK framework to analyze the effect of macroeconomic volatility on growth, while Acemoglu and Ventura (2003) use the AK model to analyze the effects of terms of trade on growth.

In summary, the endogenous growth theory says that the long run growth rate of an economy depends on R&D and innovation which in turn is related to policy measures. Subsidies for research and development or education increase the growth rate in endogenous growth models by increasing the incentive for innovation.

It should be noted that recently, fundamental sources of growth such as institutions and socio-cultural factors are also found in the economic growth literature. Indeed, the literature has identified some institutions and cultures which are important for growth, notably property rights (Acemoglu, Johnson and Robinson, 2001; Goldstein and Udry, 2008), corruption (Mo,
It is argued that countries with more secure property rights invest more in physical and human capital and use these factors more efficiently. Indeed, the incentive to invest depends on the expectation of rights over the returns to the investment made. A conflict context is often filled with uncertainty with regard to property rights and therefore impacts growth. Similarly, if corruption increases during war, this can reduce growth via its negative effect on innovation. This may happen if corruption tends to over protect established producers by imposing heavy bribes and expropriations to innovators. However, corruption can also have a positive effect on growth by providing a leeway for entrepreneurs to bypass inefficient regulations. Overall, the strength of the institutions that are good for growth may be determined by social cohesion as Easterly et al (2006) argue. Countries divided along class or ethnic lines may find it difficult to improve the quality of institutions.

Hence, the effect of war on equilibrium income level and economic growth should go through physical capital, human capital, institutions, culture and other fundamental sources of growth. In the short term, output level and economic growth may be affected via the same channels. For instance, destruction of bridges during war has immediate effects on the economy; the same for emigration or death of intellectuals, deterioration of the rule of law, etc.

4. Empirical Literature review

Empirical investigations on economic consequences of civil wars have exposed their adverse effects (see for example Collier, 1999; Rodrick, 1999; Cerra and Saxena, 2008).

In a much cited paper in the civil war literature, Collier (1999) finds that GDP per capita declines at an annual rate of 2.2% during war. This figure implies that for a conflict that lasts 5 years, GDP per capita is expected to fall by roughly 10% during the conflict. More recently, the United Nations Development Programme (UNDP) Bureau for Crisis Prevention and Recovery has estimated that civil war reduced a country’s GDP by 1.7% to 3.3% per year before 1990 and by approximately 12.3% after 199010 (UNDP, 2008). These results are of course sensitive to the choice of the counterfactual. This issue is dealt with by considering

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10 This finding is heavily driven by the economic collapse of several countries that emerged after the dissolution of the USSR.
that the counterfactual performance is either: (1) the economic performance during peace (Collier, 1999); (2) the trend of the economic indicator before conflict outbreak; (3) the trajectory of a “similar” country or countries that remained peaceful (Abadie and Gardeazal, 2003). In our view, while the first two methods are relatively suited for short conflict periods, the third one is the most appropriate for conflicts that last many years. This is because economic performance in peaceful periods is not constant just as the trend may vary for many reasons other than conflict.

Regarding the mechanism through which conflict affects the economy, Collier (1999) provides an explanation of the decline which is centered on the gradual loss of capital stock due to destruction, dissaving and “portfolio substitution” by private agents who shift their assets (physical and human capital) out of the country. This capital flight also results in low levels of new investments which lead to the deterioration of the existing capital (Collier et al., 2004). In the case of many developing countries, cattle and other farm assets often represent a substantial part of household’s savings, which may be destroyed or stolen during civil war (see Tilman Bruck (1996) for the case of Mozambique; Annan, Blattman and Horton (2006) for the case of Uganda).

Empirical research has also shown that civil wars devastate lives directly through battle related deaths and mutilations, and indirectly through diseases (malaria, cholera, yellow fever and other illnesses) and famine. For instance, Lacina and Gleditsch (2004) estimate that civil war in the Democratic Republic of Congo caused 145 000 battle-deaths and approximately 2.5 million indirect deaths from 1998 to 2001. Human capital may also become impaired by the breakdown of health and school systems during conflict as public expenditure is diverted to military expenditure at their expense (Knight et al., 1996). For instance, military expenditure during the Burundian civil war went from approximately 4% of GDP in 1994 to 8% in 2001 while the share of spending on education stagnated at 4% (Ndikumana, 2005). On average, Collier and Hoeffler (2004) found that civil war raises military spending as a share of GDP by 1.8% percentages points per year.

Compared to physical and human capital, the quantitative effect of civil war on institutions, culture and other fundamental determinants of economic growth is less well known owing perhaps to the difficulty of measuring it. Mo (2001) found that a 1% increase in the corruption level reduces the growth rate by about 0.72% via mainly the effect of corruption on political instability.
However, the effect of war on institutions need not have a destructive effect on the economy. On the contrary, civil war can destroy some political and social institutions that inhibited development in the first place (Van Raemdonck and Diehi, 1989; Blattman and Miguel, 2010; Bove et al, 2016) and give way to institutional changes, technological innovations and social developments that stimulate growth. For instance, Nkurunziza and Ngaruko (2005) argue that the Burundian Civil war (1993 – 2003) weakened a small group of rent seekers who had blocked socio-economic changes for decades. Internal warfare is also believed to change time and risk preferences of individuals (Nillesen, 2016), social cooperation and civic engagement (Bauer et al, 2016). Most of these changes are likely to occur in the aftermath of the conflict but not always. By comparing Somalia’s economic performance before and after it became stateless in 1991, Leeson (2007) and Powell et al. (2008) actually find that the country improved on a number of indicators, notably law and order, during war. Instead of providing social order, the pre-war Somali government “suck the life out of the economy” (Powell et al., 2008).

Although cross-country studies dominate the empirical literature on the economic cost of conflict, these are criticized for not taking into consideration country specific responses to conflict shocks (Bove et al., 2016). As these last authors argue, conflicts should not be assumed to produce the same outcome in different economies. The cross-country literature is also criticized for not properly controlling for institutional and social time varying variables which can affect both the probability of war and economic growth. Case studies are also limited in that they often don’t allow generalization. This study attempts to estimate economic costs of civil conflicts in Burundi with these issues in mind.

5. Methodology

We recall that the aim of this study is to estimate the economic costs of the conflicts experienced by Burundi from 1970 to 2015 with a focus on the 1993 to 2003 and the 2015 conflicts. We start by regressing GDP growth on a number of economic growth predictors. We then move on estimate counterfactual GDP per capita trajectories using different methods: the synthetic control method, various filtering techniques and OLS trends. We first
present the theory behind these different methods\textsuperscript{11} before we present the results of their application.

5.1. Examining the effect of civil conflicts on economic growth

To assess the effect of civil conflicts on economic growth in Burundi, the following equation is estimated for the period 1970 to 2015:

\[
g_t = \beta_0 + \beta_1 \text{CIVCON}_t + X'_t \theta + \varepsilon_t
\]

\(g\) denotes economic growth, \(\text{CIVCON}\) stands for civil conflicts; it is a dummy variable taking the value of 1 for a conflict year and 0 otherwise. In addition to the dummy variable, an indicator of conflict intensity is used. \(X\) is the vector of control variables and \(\varepsilon_t\) is the error term.

Arvanitidis et al. (2009) highlights factors affecting a country’s economic growth found in the literature (see also Barro 1991, 1997; Barro and Sala-i-Martin, 1995; Edwards, 1998; Dollar and Kraay, 2000; Rodrik, 2000, etc.). These include, among others, the rate of investment, foreign direct investment, official development assistance, human capital, innovation and R&D activities, economic policies and macroeconomic conditions, openness to trade, institutions, demography, etc.

In this study, in examining the impact of civil conflicts on economic growth, we consider the following pool of control variables: openness to trade, investment rate, population growth rate, inflation rate, official development assistance (% GNI), institution quality captured by polity2 index, change in the real effective exchange rate, agriculture value added (% GDP), household final consumption expenditure (% GDP), primary school enrollment, industrial value added (% GDP), services value added (% GDP), military expenditure (% GDP), external debt stock (% GNI), government expenditure (% GDP), total natural resources rents (% GDP), broad money (% GDP), domestic credit to private sector (% GDP). The description of the variables and their descriptive statistics are in Table A.1 and table A.2 of the Appendix

Extreme Bounds Analysis (EBA) is used in analyzing the impact of civil conflicts on economic growth because of the uncertainty on the variables to consider as control variables. As Sala-i-Martin (1997) points out, the impact of a focus variable in a regression depends on the combination of the control variables in the equation. The use of Extreme Bounds Analysis

\textsuperscript{11} Except the well known OLS.
here is therefore to show the effect of a changing set of control variables on the estimated
effect of civil conflicts. The idea of Extreme Bounds Analysis is to find out which variables
from the set X are robustly associated with the dependent variable y. This is done by running
a number of regression models combining variables in the set X (Marek, 2016). In Extreme
Bounds Analysis (see, next equation), some variables are “focus” variables, others are
considered as “free” (fixed) to be included in all regressions, while others are “doubtful”
variables.

\[ y = \alpha_j + \beta_{jy} v + \beta_{jF} F + \beta_{jD} D_j + \varepsilon \],

where \( y \) is the GDP growth rate, \( v \) is the focus variable, \( F \)
is the set of free variables, and \( D_j \) is a vector of doubtful variables taken from the set X of
variables. Following Levine and Renelt (1992) and Sala-i-Martin (1997), 3 doubtful variables
are included in each combination.

To decide on the free variables to include, we follow Marek (2016) and run a naïve\(^{12}\)
Extreme Bounds Analysis, which provides a particularly strong test for a determinant’s robustness.
According to Marek (2016), this might indicate which variables should be treated as free.
From our naïve EBA results\(^{13}\), it seems that inflation rate, population growth rate, openness
to trade, primary school enrolment, domestic credit to private sector, and official
development assistance, are the most robust determinants\(^{14}\) of economic growth. We consider
them as free variables but we divide them into two sets, one set comprising of inflation rate,
openness to trade and population growth rate, and another set of official development
assistance, domestic credit to private sector, and primary school enrolment. Sala-i-Martin
(1997) considers as free variables, the investment rate, secondary school enrolment rate and
rate of population growth.

To determine whether a focus variable \( v \) is robust or fragile in determining \( y \), Leamer (1985)
defines the lower and upper extreme bounds as the minimum and maximum values of
\[ \hat{\beta}_j \pm \tau \hat{\rho}_j \] across the M estimated regression models, where \( \hat{\beta}_j \) is the estimated regression
coefficient, \( \hat{\rho}_j \) is the standard errors, and \( \tau \) is the critical value for the requested confidence
level. If the upper and lower extreme bounds have the same sign, the focus variable \( v \) is said

\(^{12}\) It is called naïve because all the doubtful variables are regarded as focus. In addition, it does not take into
account the possibility of high multicollinearity among the included variables, neither does it account for the
possibility that some variables measure similar concepts.

\(^{13}\) See Figure A.1 in the Appendix

\(^{14}\) Variables for which all of the estimated regression coefficients have the same sign
to be robust. But, if the bounds have opposite signs, the variable is said to be fragile. This makes Leamer’s (1985) EBA too strong and very few or no variable actually pass it. However, Sala-i-Martin (1997) suggests another approach focusing on the entire distribution of regression coefficients, not just on its extreme bounds. Extreme Bounds Analysis proposed by Sala-i-Martin (1997) considers a variable more robust if a greater proportion of its coefficient estimates lies on the same side of zero. According to Sala-i-Martin (1997), a focus variable \( v \) is robust if the Cumulative Density Function of all the regression coefficients is larger than 95%.

5.2 Estimating the Cost of Conflict: a Synthetic Control Method

To estimate differently the economic costs of civil conflicts, this study applies the synthetic control method developed by Abadie and Gardeazabal (2003). The focus in this section is on the 1993 – 2003 civil war. As it was previously indicated, episodes of civil conflicts before 1993 (1965, 1969, 1972, 1988, and 1991) were short-lived and do not seem to have caused significant economic impact. In this study, the outcome variable of interest is the GDP per capita. Thus, we seek to examine the economic cost of the 1993 civil conflict on GDP per capita. Using the synthetic control method, this consists of estimating the lost GDP per capita due to the 1993 civil war. In other words, we want to estimate what would have been the level of GDP per capita if the 1993 civil war hadn’t happened. To get that, we take the difference between the actual GDP per capita during the 1993 civil war period and the counterfactual GDP per capita or the synthetic control.

Abadie et al. (2014) indicate that the synthetic control is defined as the weighted average of the units in the donor pool (untreated units), which is represented by a \((J*1)\) vector of weights \( w = (w_2, \ldots, w_J) \), with \( 0 \leq w_j \leq 1 \) for \( j = 2, \ldots, J \) and \( w_2 + \ldots + w_{J+1} = 1.15 \)

The weights are chosen in such a way that the formed synthetic control mimics as closely as possible the behavior of the treated unit of interest before the intervention (Costalli et al., 2014), that is, before the 1993 civil war for our case. As Abadie et al. (2014) point out, “the pre-intervention characteristics of the treated unit can often be much more accurately approximated by a combination of untreated units than by any single untreated unit”.

15 Note that the subscript 1 corresponds to the treated unit. In our case Burundi.
According to Abadie et al. (2014), the synthetic control is chosen by minimizing the following difference $\|X_1 - X_0W\|^{16}$, where $X_1$ is the $(k*1)$ vector of the values of the characteristics of the treated unit in the pre-intervention period, while $X_0$ is the $(k*J)$ matrix of the values of the same variables for the control group. Abadie et al. (2014) suggest that the pre-treatment characteristics to use can be the determinants of economic growth, such as investment rate, education attainment, industry share of value added, inflation, openness to trade, etc.

In an earlier paper, Abadie et al. (2010) suggest choosing the synthetic control $W$ by minimizing the following expression:

$$\sum_{m=1}^{k} v_m (X_{1m} - X_{0m}W)^2$$

Subject to: $w_2 + \ldots + w_{J+1} = 1$, and $0 \leq w_j \leq 1$, where $v_m$ is the weight showing the importance assigned to the $m^{th}$ variable when measuring the $\|X_1 - X_0W\|$.

The impact of the intervention in the post-intervention period at time $t$ is given by:

$$Y_{it} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$$

where $Y_{it}$ is the value of the outcome at period $t$ for the treated unit and $\sum_{j=2}^{J+1} w_j^* Y_{jt}$ represents the counterfactual, that is, the synthetic control.

To sum up using the impact evaluation vocabulary: the treated unit is Burundi, the treatment is the 1993 civil war, the outcome variable is GDP per capita, the intervention period is 1993 - 2003, the pre-treatment period is 1970-1992.

Countries used to construct the synthetic control were chosen from the list of Sub-Saharan Africa countries of the World Bank. We first excluded from that list countries which experienced any armed conflict, following the definition of the UCDP/PRIO (see Gleditsch et al., 2002)\(^\text{17}\), from 1993 to 2003. We then selected countries whose GDP per capita, the

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\(^{16}\) The distance can be measured in different ways (using the concept of euclidian distance for example)

\(^{17}\) Two types of armed conflict are defined in the database: a minor armed conflict which occurs between the government of a state and one or more internal opposition group(s) and causes at least 25 battle-related deaths in a single year; and a civil war which also occurs between the government of a state and one or more internal opposition group(s) but causes at least 1000 battle-related deaths in a single year.
outcome variable, in 1992 was not more than 200 USD\textsuperscript{18} away from that of Burundi.\textsuperscript{19} So the final donor pool is composed of Burkina Faso, Madagascar, Malawi, Mozambique and Togo.

We used annual country-level panel data for the period 1970 – 2003, which gives a pre-intervention period of 23 years and a post-intervention period of 10 years. For the pre-war characteristics in $X_1$ and $X_0$ we essentially use growth predictors that are found significant in regressions below.

5.3 Estimating the Potential Growth with filters

To estimate the cost of civil conflicts in terms of lost GDP growth, potential growth can also be estimated. Estimating potential growth consists of distinguishing short term fluctuations (the business cycle) from the trend. A number of techniques have been suggested to estimate potential growth. These include univariate statistical methods involving detrending and filtering techniques, multivariate unobservable components methods, decompositions based on Structural Vector Autoregressive models and production function approaches.

Using univariate framework, the estimation of potential growth reduces to separating the trend from the cycle for a given GDP growth series. This can be done by using a linear trend approach, filtering methods suggested by Baxter and King (1995), and Hodrick and Prescott (1997) [known as HP filter]. Hamilton (2017) criticizes the HP filter by pointing out that HP filter produces series with spurious dynamic relations that have no basis in the underlying data-generating process, and that the filtered values at the end of the sample are very different from those in the middle, and are also characterized by spurious dynamics. Hamilton (2017) then suggests a better alternative.

Other multivariate approaches exist such as Multivariate HP filter, the multivariate extension of the Beveridge-Nelson decomposition method, the structural VAR proposed by Blanchard and Quah (1989), as well as the production function approach.

\textsuperscript{18} We do not consider the 200 dollars in a relative sense but rather from an absolute perspective. We suppose that a difference of 200 dollars between GDP per capitas is not significant given how imprecise the indicator is, especially in poor countries (See Jerven (2013) for more details).

To make an analogy, we normally don’t consider a student who has 2 marks out of 20 to be two times better than a student who has 1 out of 20. Rather, we simply say that the two students have a low mark.

However, we acknowledge that the choice of a 200 USD interval remains, to a certain extent, arbitrary. We therefore experimented with intervals of 50 USD and 100 USD. Using the latter intervals, the synthetic control is constructed using Burkina Faso and Malawi, but is less close to Burundi before the 1993 civil war (See Figure A in appendix).

\textsuperscript{19} Tanzania and The Gambia were among this last group but were not selected because of substantial missing observations.
6. Results’ Presentation

Before any other analysis, to avoid a spurious regression later, we examine the properties of the variables, whether they follow a stationary process or not. Phillips-Perron\textsuperscript{20} unit root tests results are presented in Table 1.

Table 1: Unit Root Tests Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>LEVEL</th>
<th>FIRST DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P-value</td>
<td>P-value</td>
</tr>
<tr>
<td>Primary school enrolment</td>
<td>0.692</td>
<td>0.002</td>
</tr>
<tr>
<td>Real effective exchange rate change</td>
<td>0.000</td>
<td>-</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>0.000</td>
<td>-</td>
</tr>
<tr>
<td>Population growth</td>
<td>0.517</td>
<td>0.048</td>
</tr>
<tr>
<td>ODAR</td>
<td>0.601</td>
<td>0.000</td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>0.000</td>
<td>-</td>
</tr>
<tr>
<td>Industrial value added (% GDP)</td>
<td>0.191</td>
<td>0.000</td>
</tr>
<tr>
<td>Agriculture value added (% GDP)</td>
<td>0.000</td>
<td>-</td>
</tr>
<tr>
<td>Trade openness</td>
<td>0.336</td>
<td>0.000</td>
</tr>
<tr>
<td>Gross fixed capital formation (% GDP)</td>
<td>0.354</td>
<td>0.000</td>
</tr>
<tr>
<td>Services value added (% GDP)</td>
<td>0.088</td>
<td>0.000</td>
</tr>
<tr>
<td>Military expenditure (% GDP)</td>
<td>0.923</td>
<td>0.000</td>
</tr>
<tr>
<td>Debt stock (% GDP)</td>
<td>0.987</td>
<td>0.000</td>
</tr>
<tr>
<td>Domestic credit to private sector (% GDP)</td>
<td>0.177</td>
<td>0.000</td>
</tr>
<tr>
<td>Broad money (% GDP)</td>
<td>0.009</td>
<td>-</td>
</tr>
<tr>
<td>General government final consumption expenditure (% GDP)</td>
<td>0.381</td>
<td>0.000</td>
</tr>
<tr>
<td>Total natural resources rents</td>
<td>0.341</td>
<td>0.000</td>
</tr>
<tr>
<td>Household final consumption expenditure (% GDP)</td>
<td>0.001</td>
<td>-</td>
</tr>
</tbody>
</table>

Phillips-Perron unit root tests indicate that Real GDP growth, Change in the real effective exchange rate, Inflation rate, Agriculture value added (% GDP), Broad money (% GDP), and

\textsuperscript{20}Two unit root tests are mostly used in the empirical literature (ADF and PP) but PP is said to have a greater power over ADF
Household final consumption expenditure (% GDP) are stationary processes. The rest of the variables, i.e. Primary school enrolment, Population growth, Official development assistance (% GDP), Industrial value added (% GDP), Trade openness, Gross fixed capital formation (% GDP), Services value added, Military expenditure (% GDP), Debt stock (% GDP), Domestic credit to private sector (% GDP), General government final consumption expenditure (% GDP) and Total natural resources rents, are non-stationary variables becoming stationary after one differentiation. These non-stationary variables are therefore considered in first difference in the regressions.

6.1. EBA Regression Results

To examine the impact of civil conflicts on economic growth, we first capture civil conflicts by a dummy variable taking the value of 1 in the year of civil conflicts and 0 otherwise; the results are presented in Table 2.1. For our focus variable, “civil conflict dummy” (CIVCON), the EBA results\(^\text{22}\) show that for the two sets of free (fixed) variables considered, all the estimated coefficients (100%) for all the 939 regressions are negative (See Figure 3). The estimated coefficients are also found to be statistically significant for almost all the regressions (100% with the first set of free variables, and 99.75% for the 2\(^{nd}\) set). This implies that civil conflicts are harmful to economic growth in Burundi. Moreover, the results indicate that 99.9% of the Cumulative Density Function (CDF) of all the estimated coefficients lies below zero. According to Sala-i-Martin (1997)\(^\text{23}\), this suggests that the civil conflicts dummy variable is robustly associated with economic growth. The average coefficient across all the 939 regressions is respectively -3.907 and -4.189 for the 2 sets of free variables. This shows that on average, holding all else equal, civil conflicts reduced economic growth by 4 percentage points.

The results further show that for the free variables considered, the estimated coefficients for all the regressions are all positive for primary school enrollment, openness to trade, and population growth rate, all negative for inflation rate, while some few (less than 0.5%) coefficients are negative for ODA and domestic credit to private sector. The majority of the estimated coefficients are statistically significant for inflation rate (99.4%), population growth rate (81.3%), primary school enrollment (64%), while for openness to trade, only 18.9% of the coefficients are significant and none for ODA and domestic credit to private

\(^{21}\) Results are from an R package “ExtremeBounds” of Marek (2016).
\(^{22}\) 939 regressions were estimated, corresponding to the number of combinations among the doubtful variables.
\(^{23}\) Sala-i-Martin (1997) considers to be robust the variables whose CDF is larger than 95%.
sector. Looking at the distribution (CDF) of the coefficients, primary school enrollment, inflation rate and population growth rate, are robustly correlated with economic growth. Primary school enrollment and population growth rate are found to be positively correlated with economic growth while inflation is negatively correlated with growth.
Table 2.1: Impact of civil conflicts on economic growth

Panel A: Impact of civil conflicts considering the first set of the free variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Weighted Mean of $\beta$</th>
<th>S.E.</th>
<th>% ($\beta &lt; 0$)</th>
<th>% ($\beta &gt; 0$)</th>
<th>% (significance $\beta &lt; 0$)</th>
<th>% (significance $\beta &gt; 0$)</th>
<th>% CDF ($\beta &lt; 0$)</th>
<th>% CDF ($\beta &gt; 0$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.914</td>
<td>2.861</td>
<td>0.122</td>
<td>99.878</td>
<td>0.000</td>
<td>57.579</td>
<td>5.084</td>
<td>94.916</td>
</tr>
<tr>
<td>ODA</td>
<td>0.099</td>
<td>0.124</td>
<td>0.489</td>
<td>99.511</td>
<td>0.000</td>
<td>0.000</td>
<td>22.721</td>
<td>77.279</td>
</tr>
<tr>
<td>PSEN</td>
<td>0.212</td>
<td>0.102</td>
<td>0.000</td>
<td>100.00</td>
<td>0.000</td>
<td>64.425</td>
<td>2.456</td>
<td>97.544</td>
</tr>
<tr>
<td>DCPS</td>
<td>0.114</td>
<td>0.276</td>
<td>0.122</td>
<td>99.878</td>
<td>0.000</td>
<td>0.000</td>
<td>34.434</td>
<td>65.566</td>
</tr>
<tr>
<td>CIVCON</td>
<td>-3.907</td>
<td>1.160</td>
<td>100.00</td>
<td>0.000</td>
<td>100.00</td>
<td>0.000</td>
<td>99.940</td>
<td>0.060</td>
</tr>
</tbody>
</table>

Panel B: Impact of civil conflicts considering the second set of the free variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Weighted Mean of $\beta$</th>
<th>S.E.</th>
<th>% ($\beta &lt; 0$)</th>
<th>% ($\beta &gt; 0$)</th>
<th>% (significance $\beta &lt; 0$)</th>
<th>% (significance $\beta &gt; 0$)</th>
<th>% CDF ($\beta &lt; 0$)</th>
<th>% CDF ($\beta &gt; 0$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>8.149</td>
<td>2.691</td>
<td>0.122</td>
<td>99.878</td>
<td>0.000</td>
<td>88.509</td>
<td>1.722</td>
<td>98.278</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.164</td>
<td>0.056</td>
<td>100.00</td>
<td>0.000</td>
<td>99.389</td>
<td>0.000</td>
<td>99.632</td>
<td>0.368</td>
</tr>
<tr>
<td>OPENNESS</td>
<td>0.135</td>
<td>0.082</td>
<td>0.000</td>
<td>100.00</td>
<td>0.000</td>
<td>18.949</td>
<td>6.514</td>
<td>93.486</td>
</tr>
<tr>
<td>POPGR</td>
<td>5.504</td>
<td>2.360</td>
<td>0.000</td>
<td>100.00</td>
<td>0.000</td>
<td>81.296</td>
<td>1.640</td>
<td>98.360</td>
</tr>
<tr>
<td>CIVCON</td>
<td>-4.189</td>
<td>1.157</td>
<td>100.00</td>
<td>0.000</td>
<td>99.756</td>
<td>0.000</td>
<td>99.933</td>
<td>0.067</td>
</tr>
</tbody>
</table>

Note: In this table, civil conflicts are captured by a dummy variable (CIVCON). Column (4) reports the percentage of negative coefficients and column (6) the percentage of negative coefficients which are significant.
As a robustness check, we examine the impact of civil conflicts by categorizing civil conflicts by intensity. The intensity variable is coded in two categories; minor armed conflict (between 25 and 999 battle-related deaths in a given year) and major armed conflict (at least 1,000 battle-related deaths in a given year). War intensity dummy variables are from UCDP/PRIO Armed Conflict Dataset. The results presented in Table 2.2 indicate that all the 1789 estimated coefficients\(^{24}\) for the two dummy variables (MINCON and MAJCON) are negative for the two sets of free variables included, except for MINCON in the regression including inflation rate, openness to trade and population growth rate as fixed (free) variables, where a small proportion of coefficients (0.1%) are found to be positive. We find that for major conflicts (MAJCON), more than 95% of the estimated coefficients are negatively and statistically significant, while for minor conflicts (MINCON), only 24.4% and 53.2% are statistically significant respectively for the 2 sets of free variables considered. The Sala-i-Martin EBA test indicates that major conflicts dummy variable (MAJCON) is robustly correlated with economic growth (more than 99% of the Cumulative Density Function (CDF) of all the estimated coefficients lies below zero), while the robustness of the minor conflicts dummy variable (MINCON) depends on the free variables included. Major conflicts seem to reduce economic growth by 5% while minor conflicts reduce it by around 2% in Burundi. Among the free variables considered, only inflation, population growth rate and primary school enrolment rate are robust determinants of economic growth.

\(^{24}\) 1789 regressions were estimated.
Table 2.2: Impact of civil conflicts on economic growth

Panel A: Impact of civil conflicts considering the first set of the free variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Weighted Mean of β</th>
<th>S.E</th>
<th>% (β &lt; 0)</th>
<th>% (β &gt; 0)</th>
<th>% (significance β &lt; 0)</th>
<th>% (significance β &gt; 0)</th>
<th>CDF (β &lt; 0)</th>
<th>CDF (β &gt; 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>8.760</td>
<td>2.868</td>
<td>2.627</td>
<td>97.373</td>
<td>0.000</td>
<td>80.660</td>
<td>3.639</td>
<td>96.361</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.195</td>
<td>0.065</td>
<td>100.000</td>
<td>0.000</td>
<td>95.137</td>
<td>0.000</td>
<td>99.556</td>
<td>0.444</td>
</tr>
<tr>
<td>POPGR</td>
<td>5.940</td>
<td>2.890</td>
<td>0.000</td>
<td>100.000</td>
<td>0.000</td>
<td>48.351</td>
<td>4.182</td>
<td>95.818</td>
</tr>
<tr>
<td>OPENNESS</td>
<td>0.135</td>
<td>0.107</td>
<td>0.168</td>
<td>99.832</td>
<td>0.000</td>
<td>15.484</td>
<td>13.752</td>
<td>86.247</td>
</tr>
<tr>
<td>MINCON</td>
<td>-2.219</td>
<td>1.318</td>
<td>99.897</td>
<td>0.103</td>
<td>24.408</td>
<td>0.000</td>
<td>93.165</td>
<td>6.835</td>
</tr>
<tr>
<td>MAJCON</td>
<td>-5.234</td>
<td>1.468</td>
<td>100.000</td>
<td>0.000</td>
<td>98.146</td>
<td>0.000</td>
<td>99.662</td>
<td>0.338</td>
</tr>
</tbody>
</table>

Panel B: Impact of civil conflicts considering the first set of the free variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Weighted Mean of β</th>
<th>S.E</th>
<th>% (β &lt; 0)</th>
<th>% (β &gt; 0)</th>
<th>% (significance β &lt; 0)</th>
<th>% (significance β &gt; 0)</th>
<th>CDF (β &lt; 0)</th>
<th>CDF (β &gt; 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.854</td>
<td>2.944</td>
<td>5.198</td>
<td>94.802</td>
<td>0.000</td>
<td>65.903</td>
<td>7.680</td>
<td>92.320</td>
</tr>
<tr>
<td>ODA</td>
<td>0.116</td>
<td>0.141</td>
<td>6.931</td>
<td>93.069</td>
<td>0.000</td>
<td>0.838</td>
<td>23.800</td>
<td>76.200</td>
</tr>
<tr>
<td>DCPS</td>
<td>0.110</td>
<td>0.281</td>
<td>36.445</td>
<td>63.555</td>
<td>0.000</td>
<td>0.000</td>
<td>35.873</td>
<td>64.127</td>
</tr>
<tr>
<td>PSEN</td>
<td>0.246</td>
<td>0.104</td>
<td>0.000</td>
<td>100.000</td>
<td>0.000</td>
<td>70.933</td>
<td>2.485</td>
<td>97.515</td>
</tr>
<tr>
<td>MINCON</td>
<td>-2.608</td>
<td>1.288</td>
<td>100.000</td>
<td>0.000</td>
<td>53.244</td>
<td>0.000</td>
<td>97.012</td>
<td>2.988</td>
</tr>
<tr>
<td>MAJCON</td>
<td>-4.886</td>
<td>1.817</td>
<td>100.000</td>
<td>0.000</td>
<td>95.263</td>
<td>0.000</td>
<td>99.281</td>
<td>0.719</td>
</tr>
</tbody>
</table>

Note: In this table, civil conflicts are categorized by intensity, minor conflict (MINCON) and major conflict (MAJCON)
Figure 3: Distribution of estimated coefficients for the variable “Civil Conflicts” (dummy variable)

Note: The 2 figures are for the two sets of free variables respectively

Figure 4: Distribution of estimated coefficients for the variable “Civil Conflicts” (conflict intensity)

Note: The figures are for the two sets of free variables.

We first estimate the counterfactual path of the GDP per capita of Burundi, had the country not experienced war in the 1993 – 2003 period, using the synthetic control method. Recall that the synthetic Burundi is a combination of comparison countries such that its characteristics (growth predictors) best resemble those of the actual Burundi in the pre-civil war period. As stated earlier, weights associated to the different countries in the synthetic control, \( w^* \), depend on the weights, \( v_m \), attributed to the growth predictors. These \( v_m \) weights reflect the importance assigned to the different growth predictors. Referring to the results of the previous section, we have fixed the \( v_m \) weights as follows\(^{25} \): Primary School Enrollment (0.024), Inflation (0.019), Population Growth (0.656), GDP per Capita in 1992 (0.10), GDP per capita in 1983 (0.10) and GDP per capita in 1970 (0.10). The last three variables have been added to control for the effect of unobserved factors affecting both the outcome variable (GDP per capita) and the growth predictors (See Abadie, Diamond, and Hainmueller (2010) for a detailed explanation).

The following country weights were obtained through constrained quadratic programming in Stata\(^{26} \): Burkina Faso (0.796), Mozambique (0.167), Togo (0.021), Madagascar (0.016) and Malawi (0). Therefore the constructed synthetic Burundi is a weighted average of the latter countries (except Malawi). The country with the largest weight, i.e. Burkina Faso, indeed resembles Burundi in many characteristics other than the ones considered in our study. We discuss in the following section the evolution of Burkina Faso, as well as Mozambique, from 1970 to 2003 from an economic and political perspective.

Table 3 compares the means of growth predictors of the actual, the synthetic Burundi and the population-weighted averages of the sample of SSA countries in the donor pool over the period 1970 to 1992. These results suggest that the synthetic Burundi, i.e. a certain convex combination of Burkina Faso, Mozambique Togo and Madagascar, is a better comparison for Burundi than a simple population weighted average of the considered sample of SSA countries.

In other words, characteristics of Burundi before the 1993 civil war are better reproduced by the synthetic Burundi. Indeed, for all the characteristics considered, the corresponding values

\(^{25}\) They have been normalized to sum up to one.
\(^{26}\) Using the command synth
of the synthetic control are closer to the actual Burundi than the weighted average of donor pool countries.

Table 3. Economic Growth Predictors before the Burundian 1993 - 2003 civil war

<table>
<thead>
<tr>
<th></th>
<th>Actual Burundi</th>
<th>Synthetic Burundi</th>
<th>Weighted average of*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Growth (annual %)</td>
<td>2.2</td>
<td>2.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Primary School enrollment (% gross)</td>
<td>40</td>
<td>33</td>
<td>71</td>
</tr>
<tr>
<td>Inflation</td>
<td>9</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>GDP per capita in 1992</td>
<td>333</td>
<td>325</td>
<td>318</td>
</tr>
<tr>
<td>GDP per capita in 1983</td>
<td>298</td>
<td>308</td>
<td>340</td>
</tr>
<tr>
<td>GDP per capita in 1970</td>
<td>265</td>
<td>265</td>
<td>373</td>
</tr>
</tbody>
</table>

*Burkina Faso, Madagascar, Malawi, Mozambique and Togo.

6.2.1 The GDP per capita cost of the 1993-2003 civil war

Figure 5 plots the path of the GDP per capita of the synthetic Burundi and the actual Burundi. While the synthetic Burundi almost exactly reproduces the pre-1993 path of Burundi, the relationship of Burundi with the SSA sample is much less tight as can be seen in Figure 6. It is therefore relatively accurate to consider the synthetic Burundi as the counterfactual of Burundi during the civil war period. Hence, our estimate of the cost of the civil war is given by the difference between the actual GDP per capita of Burundi and its synthetic counterpart.
Figure 5: Evolution of GDP per Capita of actual Burundi and synthetic Burundi

On average, GDP per capita fell by approximately 140 dollars yearly during the civil war period, compared to what it would have been in the absence of war. Considering that GDP per capita stood at roughly 300 USD right before the civil war, this means that on average Burundians saw their annual income reduced by almost a half because of the conflict. The total monetary cost of the war during the 1993-2003 period was USD 1520 per person (in 2010 US dollars) and almost 10 billion USD for the whole country.
6.2.2 Burkina Faso and Mozambique from 1970 to 2003

We previously determined that a good counterfactual for the GDP per capita path of Burundi from 1970 to 1993 is a weighted average of Burkina Faso, Madagascar, Mozambique and Togo, with almost all the weight on Burkina Faso (0.80) and to a less extent Mozambique (0.17). Since the synthetic control mostly resembles Burkina Faso, the following discussion mainly concerns the comparison of the “country of upright people” to Burundi. There are indeed many similarities between Burundi and Burkina Faso, even though differences, naturally, exist.

Focusing on characteristics that make Burkina Faso so close to Burundi in the pre-treatment period that have not been put in our data, we find some similarities in the fundamental determinants of growth: geography, institutions and integration (or international trade) (following Rodrik et al, 2002). Considering geography, the two countries are landlocked and have relatively scarce natural resources. Regarding international trade, we notice that they both have narrow export bases. Burundi’s main exports are coffee and tea and Burkina Faso primarily exports cattle, cotton and gold. As for institutions, in both countries the army
appears as the most powerful group since the 60s. As is the case in Burundi, from independence (1960 in Burkina Faso and 1962 in Burundi) until the beginning of the 90s, succession at the top of country has been in the form of coup d’Etats. Moreover, the two countries turned to electoral democracy in the early 90s, notably under the instigation of France, following the “Discours de la Baule” in which the President of France stated that his country would henceforth only support democratic countries (NSA, 1990). It’s shortly after the 1993 general election in Burundi (at the start of the civil war) that the economic paths of the two countries started to diverge substantially (see Figure 8).

Figure 8: Trends in GDP per Capita: Burkina Faso, Burundi and Mozambique

Since the synthetic Burundi is mainly a weighted average of Burkina Faso and Mozambique, it is important to check whether there has been any unusual positive or negative shock in the two countries between 1993 and 2003 which could bias the estimated cost. This is because a positive shock in one of the control countries would inflate the cost of the Burundian civil war and inversely a negative shock would underestimate the true cost of the war. This verification is particularly important in the case of Burkina Faso because of its relatively high weight in the synthetic control.
While the Burundian economy was in freefall in the 90s, Figure 8 suggests that Burkina Faso and Mozambique were having economic booms. The acceleration of economic growth in Burkina Faso in that period is linked to the devaluation of the “Franc CFA” (the regional currency), to better rainfall and to higher commodity prices (Koussoube et al., 2014). In the case of Mozambique, the country transitioned from more than a decade of civil war (that ended in 1992) to peace and improved macroeconomic management (Fauvet, 2000). These positive performances in the 90s are not specific to Burkina Faso and Mozambique, they are also observed in some other African countries that did not experience war during this period. This leads us to think that, as the synthetic control suggests, Burundi’s GDP per capita growth would have accelerated too in the 1993 – 2003 period, had the country remained peaceful and hence the synthetic control is a good representation of Burundi without civil war.

6.2.3 Placebo studies

In order to evaluate the credibility of our results, we conduct two placebo studies. We first assign the treatment (civil war) to a random year (1983). In other words, we calculate country weights (the synthetic control) using data from the period 1970 to 1983 (instead of 1970 to 1992). In the period after the placebo treatment (1984 -1992), the path of the synthetic Burundi should not diverge substantially from that of the actual Burundi; otherwise the results presented in Figure 5 would be indicative of a potential lack of predictive power after 1993.

Figure 9 shows results of using 1983 as a placebo year of the beginning of the Burundian civil war, 10 years before the real war actually started. As it is observed, the GDP per capita trajectory and its synthetic counterpart do not diverge substantially before 1983. More importantly, in contrast to the case where the treatment year is the beginning of the real civil war, the path of the synthetic Burundi remains close to the actual Burundi after the placebo civil war, i.e. from 1983 to 1993, and starts to move away thereafter. This result improves our confidence that cost estimated in Figure 5 reflects the impact of the civil war.
The second placebo study we conducted consists in assigning the treatment not to Burundi but to other countries in the donor pool. We then calculated the ratio of the post-treatment RMSPE to the pre-treatment RMSPE. The RMSPE is a measure of the magnitude of the discrepancy between the synthetic control and the actual outcome.\textsuperscript{27} If pre-treatment RMSPE is as large as the post-treatment RMSPE we consider that the treatment had no effect. On the other hand, if the post-treatment RMSPE is significantly larger than the pre-treatment one, this is indicative of a large effect of the intervention. Figure 10 presents results of this placebo test. All the control countries have a much lower RMSPE ratio compared to Burundi. In fact, for Burundi, the post-civil war gap is approximately 11 times larger than pre-war gap while it is less than 3 for the other countries.

\textsuperscript{27} Formula for pre-treatment RMSPE: \[ \sqrt{\sum_{t=1970}^{t=1992} \left( Y_{1t} - \sum_{j=2}^{J+1} w^j Y_{jt} \right)^2} \]
6.3. Potential Growth Result

Another way of estimating the counterfactual growth of the Burundian economy in the absence of conflict amounts to answering the following question: what would have been the economic performance of the country had it remained on its observed trend before the beginning of the conflict? Taking this approach, we estimated the potential GDP growth (or trend) of Burundi from 1970 to 2016 using the Hamilton filter, the Hodrick–Prescott filter and the Baxter-King filter. These filters remove the cyclical component of a time series in order to provide a smoothed curve or trend (see figures below).

From this perspective, the cost of conflict is calculated as the difference between a “constant” trend, i.e. a linear trend of the GDP growth before the beginning of the conflict in question (the red line on the graphs below), and the actual growth rate. This constant trend does not take into account fluctuations that are caused by the conflict contrary to the trend given by the filters.
Figure 11: Potential GDP growth using the Hamilton filter

Figure 12: Potential GDP growth using the Hodrick–Prescott (HP) filter
Our preferred estimates of the potential GDP growth are the ones given by the Hamilton filter. Even though the HP filter is the most used filter in the empirical literature, Hamilton (2017) criticized it by pointing out that HP filter produces series with spurious dynamic relations that have no basis in the underlying data-generating process, and that the filtered values at the end of the sample are very different from those in the middle, and are also characterized by spurious dynamics. Hamilton (2017) then suggests a better alternative to HP filter. Furthermore, results of the HP and Baxter-King filters are problematic in the sense that they show a strongly declining trend of the GDP growth before the 1993 civil war, which is not supported by our historical analysis.

Estimates provided by the Hamilton trend indicate that the Burundian economy shrunk on average by 8.8 percentage points per year from 1993 to 2003, while the most recent armed conflict cost 6.9 percentage points of GDP growth in 2015 and 3.7% in 2016. The other filters point to lower estimates of the cost of the conflicts.

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28 The available “actual” GDP growth rate for 2016 is a prediction. Therefore the cost of the conflict in 2016 is to be taken with precautions.
7. A Linear Trend Approach

Our last approach to estimating the counterfactual economic performance is conceptually the simplest. As it can be visualized in the graph below, we exploit two clear trends before conflict outbreak: the GDP per capita trend before 1993 up to 2003 and GDP growth trend from 2009 to 2016. We calculate the trend as a simple least square regression line before conflict outbreak. We then suppose that Burundi remained on that trend in the conflict period.

**Figure 14: Trends of GDP per capita and GDP growth**

The results of this estimation method indicate that the 1993 to 2003 civil war cost USD 1290 per person (in 2010 USD) for a total cost of more than USD 8 billion. The more recent crisis in 2015 reduced economic growth by 8.9 percentage points in 2015 and 5.6 percentage points in 2016.

8. Summary and discussion of the results

The first approach to estimating the cost of Burundian conflicts considered all the conflict episodes that the country has experienced from 1970 to 2015 in multiple regressions using the extreme bound analysis technique. The results show that GDP growth declined on average by 4 percentages during conflict.
The second approach focused on the GDP cost of the 1993 to 2003 civil war using the synthetic control method. We found that this episode of conflict cost each Burundian USD 1520 on average, for a total cost of almost USD 10 billion. Unsurprisingly, these costs are a little higher than the estimates of the trend approach (USD 1290 per person and USD 8 billion for the whole country). This is because the synthetic control hypothesizes that in the absence of the 1993 civil war, economic growth would have accelerated as it was the case in countries similar to Burundi, in particular Burkina Faso and Mozambique.

How important is the USD 10 billion for Burundi? If one considers that the GDP of Burundi was less than USD 2 billion just before the 1993 conflict, it appears that the country paid a high price for the war especially considering that the calculated cost may be underestimated given that it does not include increased expenditure on “security” during wartime. Indeed, government military expenditure quadrupled and many common citizens gave monetary or in-kind contributions, either voluntary or by force, to rebels groups.

If Burundi had remained peaceful, the synthetic control results show that its GDP per capita would have stood at nearly 450 USD at the time war ended in 2003 compared to the observed 220 USD. Although the country would have remained among the poorest in Africa, it would have ranked 37th out of 47 SSA countries (in 2003) instead of its observed position of 45th. More importantly, the income of the average Burundian would have been double what it was in 2003, which would have secured better schooling, better health, improved housing and progress in other indicators of wellbeing.

The observed fall in GDP per capita from 1993 to 2003 was a consequence of multiple factors related to war. Agriculture, then the main economic activity in Burundi, was seriously affected due to the inability of the rural population to cultivate land in times of crisis, either because they had fled the war or because of death or mutilation, which resulted in a decline in agricultural production for both food crops and cash crops (mainly coffee and tea). The livestock sector also suffered heavy losses since the beginning of the conflict, mainly due to theft and looting. According to UNDP estimates, between 32% and 46% of all farm animals were looted and/or killed during the war (UNDP, 2006), in a country where livestock is one of the main form of capital accumulation. The industry sector suffered a comparable loss.

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29 The rankings are based on WDI’s GDP per Capita data in constant 2010 USD.
30 Comprising value added in mining, manufacturing, construction, electricity, water, and gas.
(see Figure 7). On the other hand, despite a dismal business climate, the services sector\textsuperscript{31} was relatively resilient.

**Figure 7: Evolution of agriculture, industry and services value added**

![Graph showing the evolution of agriculture, industry, and services value added over time.](image)

The last two estimation approaches payed a particular attention to the 2015 conflict. While our preferred filtering technique pointed to a decrease of GDP growth in 2015 of 6.9 percentage points, the OLS trend approach suggests a slightly higher estimate of the cost of the crisis: a reduction of the GDP growth by 8.9 percentage points in 2015. We prefer this last estimate because the results of the filtering techniques are problematic since they predict that even in the absence of the 2015 conflict, economic growth would have been lower in 2015 compared to 2014, an assumption for which we have no supporting arguments.

This last conflict also affected the agriculture and industry sectors disproportionately but plausibly through different channels than the ones at play in the 1993 – 2003 civil war. One remarkable difference between the two conflicts is that the one is the 90s was spread over the whole country while the more recent one was mainly localized in the capital city Bujumbura. It is then plausible that physical and human capital destruction played a central role in the economic downturn in the first conflict more than the second one. For instance, the

\textsuperscript{31} Composed of value added in wholesale and retail trade (including hotels and restaurants), transport, education, health care, real estate services and other government, financial, professional, and personal services.
number of conflict related deaths is estimated at 30 000 per year for the 1993 – 2003 period (Ngaruko and Nkurunziza, 2003), and in hundreds in 2015 (Human Rights Watch, 2016). However, similarities between the two conflicts with regard to how they affected the economy remain. Just as the 1990s civil war, the economic environment worsened in 2015 following a substantial decrease in foreign aid and reduced attractiveness of the country for foreign investments.

9. Concluding Remarks

Unlike previous papers which studied the economic performance of Burundi, we closely examine the cost of the multiple conflicts that the country has experience since independence. Without downplaying the gravity of the human cost of war, which continues to affect the country years after a conflict has ended, we have limited our attention to the economic impact of the Burundian conflicts with a particular focus on the 1993 to 2003 and 2015 conflicts.

The calculated costs are substantial. While from 1970 to 2015 Burundian civil conflicts have on average reduced GDP growth by 4 percentage points, the 1993 – 2003 civil war was particularly costly. According to our estimations, the latter conflict cost each Burundian between USD 1290 and USD 1520, leading to a total cost between USD 8 billion and USD 10 billion. After 2003, Burundi has struggled to make up for the negative impact of the civil war. Once again, the country experienced civil conflict in 2015, which reduced GDP growth by 8.9 percentage points in 2015 compared to its counterfactual.

Today GDP per capita is still lower than what it was in 1992, before the outbreak of the civil war. The country clearly needs to make more efforts in the direction of strengthening peace and revitalizing its economy. Burundians and the international community have a role to play. We point in particular to the fact that Official development assistance received from 2003 to 2014, which totals 5 450 420 000 USD\textsuperscript{32}, is just half of the estimated cost of the war, while for instance neighboring Rwanda, which had a much shorter civil war in the 90s, has received almost twice the amount\textsuperscript{33} over the same period.

The estimated costs emphasize the importance of avoiding conflicts, which are major sources of fragility. From a brighter perspective, they highlight the benefits of sustained peace. As it

\textsuperscript{32} Source: World Development Indicators (2018). The amount is in constant 2014 USD. Data for 2016 and 2017 are not yet available on the website.

\textsuperscript{33} 9 520 680 000 USD
appears that Burundi has not cut ties with its history of conflicts, we hope that this study will draw attention of policy makers to the importance of peacebuilding. In the words of Nelson Mandela during his visit to Burundi in 2003, the “country has bled enough. It and its people now deserve enduring peace.”

References


## Table A.1: Variables descriptions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, value added (% of GDP)</td>
<td>Value added of sectors including cultivation of crops, livestock production and fishing. Degradation of natural resources is not taken into account (Gross value added).</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>Democracy</td>
<td>Variable which ranges from -10 to +10. +6 and above corresponds to democracy and -6 and below corresponds to autocracy.</td>
<td>Polity IV Project</td>
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<tr>
<td>Education (Primary)</td>
<td>School Enrollment, primary (Gross %).</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>Education (Secondary)</td>
<td>School Enrollment, secondary (Gross %).</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>Indicator</td>
<td>Description</td>
<td>Source</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Real Effective Exchange rate</td>
<td>Annual US dollars exchange rate</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>GDP per capita in Constant 2010 USD</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>Gross capital formation (% of GDP) / Investment</td>
<td>Outlays on additions to the fixed assets (equipment purchases, construction of roads, schools, etc.) of the economy plus net changes in the level of inventories.</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>Industry, value added (% of GDP)</td>
<td>Value added of sectors including manufacturing, mining, construction. Depreciation of assets is not taken into account (Gross value added).</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>Inflation (%)</td>
<td>Annual percentage change in the cost of acquiring a basket of goods and services for an average consumer.</td>
<td>World Bank, World Development Indicators (WDI)</td>
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<tr>
<td>Terms of Trade (%)</td>
<td>Computed as the export price index divided</td>
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</tr>
<tr>
<td>Indicator</td>
<td>Description</td>
<td>Source</td>
</tr>
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<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Official Development Assistance</td>
<td>Concessional loans net of principal repayment plus grants by official country agencies and multilateral agencies to promote economic development and welfare.</td>
<td>World Bank, World Development Indicators (WDI)</td>
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<td>Population Growth (%)</td>
<td>Total residents regardless of citizenship or legal status</td>
<td>World Bank, World Development Indicators (WDI)</td>
</tr>
<tr>
<td>Trade Openness (% GDP)</td>
<td>(Imports + Exports)/GDP</td>
<td>World Bank, World Development Indicators (WDI)</td>
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Table A.2: Descriptive Statistics of the Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs.</th>
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<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
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<tr>
<td>GDP per capita (Constant 2010 USD)</td>
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<td>266.59</td>
<td>37.80</td>
<td>219.18</td>
<td>337.70</td>
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<td>GDP growth rate (%)</td>
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<td>2.59</td>
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<td>GDP per capita growth rate (%)</td>
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<td>0.16</td>
<td>5.12</td>
<td>-9.31</td>
<td>19.08</td>
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<td>Gross Capital Formation (% GDP)</td>
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<td>14.02</td>
<td>7.90</td>
<td>2.78</td>
<td>30.51</td>
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<td>Openness to trade (% GDP)</td>
<td>46</td>
<td>34.09</td>
<td>8.45</td>
<td>20.96</td>
<td>54.15</td>
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<td>Agriculture Value Added (% GDP)</td>
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<td>52.83</td>
<td>9.45</td>
<td>37.33</td>
<td>70.63</td>
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<td>Industrial Value Added (% GDP)</td>
<td>46</td>
<td>16.09</td>
<td>2.84</td>
<td>10.16</td>
<td>22.47</td>
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<td>ODA (% GDP)</td>
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<td>18.69</td>
<td>9.31</td>
<td>5.87</td>
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<td>Inflation, consumer prices (%)</td>
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<td>10.61</td>
<td>8.30</td>
<td>-1.37</td>
<td>36.54</td>
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<td>Population growth (%)</td>
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<td>2.39</td>
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<td>Change in the real effective exchange rate (%)</td>
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<td>Change in the terms of trade (%)</td>
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<td>2.82</td>
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<td>School Enrollment, primary (Gross %)</td>
<td>44</td>
<td>64.02</td>
<td>36.96</td>
<td>21.60</td>
<td>135.19</td>
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<tr>
<td>School Enrollment, secondary (Gross %)</td>
<td>37</td>
<td>10.02</td>
<td>10.85</td>
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<td>42.48</td>
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<td>Democracy indicator (Polity 2 index)</td>
<td>46</td>
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**Note:** Authors, using collected data from different sources
### Table A.3: Economic Growth in Burundi

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<tr>
<td>GDP</td>
<td>3.7</td>
<td>4</td>
<td>-3.4</td>
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<td>3.4</td>
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<tr>
<td>GDP per Capita</td>
<td>1.6</td>
<td>1.4</td>
<td>-5</td>
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### Table A.4: Economic Growth in Burundi

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<tr>
<td>GDP</td>
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<td>4.5</td>
<td>4.2</td>
<td>-2</td>
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<td>2.6</td>
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<td>GDP per Capita</td>
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### Table A.5: Economic Growth in Sub-Saharan Africa

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<tr>
<td>GDP</td>
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<td>2</td>
<td>5</td>
<td>3.6</td>
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<tr>
<td>GDP per Capita</td>
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<td>1.6</td>
<td>-1.4</td>
<td>-0.8</td>
<td>2.3</td>
<td>0.8</td>
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Figure A.1: Distribution of coefficients from the Naïve EBA

- (intercept)
- dpsen
- ceer
- infl
- dpopgr
- dodar
- dindva
- agva
- dopen
- dgfcf
- dseva
- ddebtr
- ddcps
- moneyr
- dgovexp
- dnatres
- hcons

Each histogram represents the distribution of coefficients for a different variable, with the y-axis showing the frequency and the x-axis showing the coefficient values.
Figure A. 2: Evolution of GDP per Capita of actual Burundi and synthetic Burundi using intervals of 50 and 100 USD to select donor pool countries.