

Growth in Fragile States in Africa: Conflict and Post-conflict capital accumulation

Janvier D. Nkurunziza¹ (UNCTAD)

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Abstract:

This framework paper analyses the pattern of capital accumulation in Africa and its interaction with political fragility. Political fragility retards or reverses gains with respect to capital accumulation, slowing long-term economic growth. Many countries experience negative rates of capital accumulation particularly during periods of acute political instability. In post-conflict periods, countries generally continue to experience capital destruction, lending support to the “war ruin hypothesis.” This has implications for long-term economic growth in view of the strong association between capital accumulation and economic performance. The main policy implication of the analysis is that African countries and their international partners should pay more attention to capital accumulation, including capital reconstruction after periods of political instability, in order to lay the foundations for sustainable economic growth.

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1. Introduction

The concept of fragility has four major dimensions: high political instability, poor economic performance, low institutional quality, and weak governance (Gelbard et al., 2015). This framework paper focuses directly on one dimension of fragility, namely political instability, and indirectly on economic performance. This focus is motivated by the fact that many African countries have been plagued by political instability since their independences in the early 1960s, leading to anemic economic growth.

When Elbadawi and Sambanis (2000) published "Why are there so many civil wars in Africa?" covering the period between 1960 and 1999, nearly 20 African countries had experienced at least one episode of civil war. Fifteen years after the publication of the article, many wars have ended and new ones started. Nkurunziza (2010) notes that in the second half of 2007 Africa had active civil wars in three countries, namely Chad, Sudan and Somalia. After 2007, new civil wars started in countries such as the Central African Republic, Nigeria (Boko Haram), Libya, and South Sudan. Therefore, while progress has been achieved in resolving some conflicts, others have emerged suggesting that fragility associated with political instability in Africa is a dynamic phenomenon and needs to be regularly assessed.

Two concepts are used to measure the gravity of political instability. First is armed conflict defined as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths" per year (UCDP/PRIO, 2015). A civil war is an armed conflict where the casualty numbers surpass 1000 battle-related deaths per year. Hence, in any given year, while most countries in Africa are peaceful, a few experience armed conflict whereas others experience civil war. There is another group of countries that are in a post-conflict state. These different groups of countries display different socio-economic patterns. Generally, countries in civil war or armed conflict have the highest level of fragility, followed by those in post-conflict periods.

This framework paper analyzes the pattern of physical capital accumulation in Africa, contrasting experiences in the following four political states: peaceful, post-conflict, armed conflict, and war. Marshall and Cole (2014) consider capital accumulation as an important determinant of development, which in turn represents one of the three elements of the Societal-System Triad determining the quality of societal systems.² Therefore, this paper's focus on capital accumulation is motivated by the premise that it is impossible to appreciate the disparities in African countries' long-term economic performance without a good understanding of their patterns of capital accumulation. Indeed, the analysis of the sources of growth in East Asia over the last few decades has shown that high rates of investment and capital accumulation were key factors explaining their successful growth experience.

Four major issues are addressed. First, the paper re-visits the topic of armed conflict and civil war in Africa covering the period from 1970 to 2014. Using transition analysis as in Nkurunziza (2010), each country-year is classified in one of the political states discussed above. The computation of transition probabilities across states before and after the fall of the Berlin Wall is based on this information. Secondly, the paper computes capital stock estimates for 51 of the 54 African countries for which data is available and compares the pattern of capital

² The other two being conflict and governance.

accumulation across the four political states.³ Third, on the basis of the four states, the paper examines the correlations between capital accumulation and economic growth. This analysis is expected to help identify which countries have succeeded in generating and sustaining high rates of economic growth during their post-conflict period as is the case of Rwanda and Ethiopia, while others such as Burundi have failed to scale up their growth rates (Nkurunziza, 2016a). This finding also illustrates the extent to which in post-conflict settings, capital accumulation, understood as economic reconstruction, helps to create a 'peace dividend' or economic opportunities that are needed to make peacebuilding sustainable (Willems and Leeuwen, 2014). Fourth, the paper discusses some correlates of capital accumulation, before the conclusion.

The main result from the analysis is that a large number of countries destroy their capital particularly during episodes of severe political fragility. This has implications for long-term economic development given the strong correlation between capital accumulation and the rate of economic growth for most countries in the sample. Therefore, African countries and their development partners should combine efforts to speed up capital accumulation, the main channel through which they could achieve high and sustainable rates of economic growth.

The paper proceeds as follows. Section 2 presents the concepts used to analyze political states and their transitions in Africa. On the basis of these definitions, empirical transition matrices are derived and discussed. Section 3 discusses the interaction between political fragility and capital accumulation followed by a presentation of the methodology used to compute the stock of capital. Section 4 presents empirical results on capital accumulation, its correlation with economic growth, and the correlates of capital accumulation. Section 5 concludes.

2. Political states and transitions in Africa

2.1. Defining the analytical concepts

At any given time, a country is in one of the following political states: peaceful, armed conflict, war, or post-conflict. These four analytical concepts need to be defined. Armed conflict and war are used as defined above (UCDP/PRIO, 2015). For every country and year in the sample, *UCDP/PRIO Armed Conflict Dataset* provides information on whether the country-year is in armed conflict or at war. As a result, a country that neither is in a state of armed conflict nor war is considered to be in a peaceful state. Hence, each country-year observation in this dataset represents one of these three political states.

We introduce a fourth state, the post-conflict state. This state refers to the period following the end of a violent conflict. As discussed in Nkurunziza (2010) this concept presents two definitional problems. The first is how to determine the beginning of the post-conflict period. The precise end of a war or armed rebellion is often impossible to determine as it depends on how a conflict ends. Some conflicts officially end with the signature of a peace agreement by belligerents as in Burundi when the government signed a comprehensive ceasefire agreement with the main rebel group on 29 November 2003. This does not necessarily mean that hostilities end on the same date. Indeed, in Burundi, violence by another relatively small rebel group that did not sign the ceasefire agreement persisted until mid-2008. Hence, violence continued despite the signing of a ceasefire agreement.

³ Eritrea, Somalia and South Sudan are excluded from the analysis due to data limitations.

In cases where there is a landmark victory by one of the belligerents, this is adopted as the date of the end of the war. This was the case with the fall of Addis Ababa on 29 May 1991 when rebel forces overran the capital, sending Ethiopian government forces in disarray. However, violence did not totally end on this date even though most of the fighting was over. In order to avoid the difficulties associated with the exact determination of the beginning of the post-conflict period, the year following one during which the conflict officially ended is adopted as the beginning of the post-conflict period, as provided for in the UCDP/PRIO Armed Conflict Dataset.

The other difficulty is when a post-conflict period ends. There is no agreed definition of the duration of a post-conflict period. Reaching pre-war economic conditions such as income per capita or another benchmark could be a good indicator of the end of post-conflict reconstruction or the post-conflict period. However, it is difficult to motivate the choice of a specific indicator that should be used. In this paper, we choose a period of ten years after a war has ended as the post-conflict period. This is arbitrary but has been adopted in other studies (Nkurunziza, 2010; Collier and Hoeffler, 2004; Collier et al., 2001).

2.2 Transition analysis

According to UCDP/PRIO Armed Conflict Dataset any African country C at any time t is in one of these three states: **Armed Conflict, War, or Peace (or Peaceful)**. These states have also been adopted, in a different context, by Hegre et al. (2015) who identify them as minor conflict, major conflict, and no conflict, respectively (p. 12).

In the second part of the transition analysis, armed conflict and war are combined into one state called **Instability** and a new state, labelled **Post-conflict**, is created to reflect the specific situation of countries emerging from severe political instability. We do not consider the period after the end of an armed conflict as a post-conflict period. Armed conflicts generally have limited effects on society than civil wars which have lingering effects that may last for several years after the major conflict has ended. Therefore, being in Instability could be the result of war or armed conflict. Since the Post-conflict state is the ten-year period that follows the end of a war—not armed conflict, the end of which could lead directly to the Peace state—a country could transition from Instability to Peaceful state. We assume that after the post-conflict period a country is considered to be either peaceful or in *Instability* either as a result of the continuation of minor conflict or reversion to war.⁴ If a country neither is in *Post-conflict* nor in *Instability*, it is in the **Peace** state.

Mobility across the three states is captured in transition matrices also called stochastic matrices. They show the conditional probability that a country is in state j in period $t + \tau$ given that it was in state i in period t . This probability is noted:

$$P[C(t + \tau) = j | C(t) = i] \quad (1)$$

Where τ represents a one-year period. The transition probabilities from state i to state j between period t and $t + \tau$ are noted:

$$p_{ij}(t + \tau) = P[C(t + \tau) = j | C(t) = i] \quad (2)$$

⁴ Some countries fall back into war less than 10 years into the post-conflict state.

With three political states, the transition matrix P is represented as:

$$P = \begin{pmatrix} p_{11} & p_{12} & p_{13} \\ p_{21} & p_{22} & p_{23} \\ p_{31} & p_{32} & p_{33} \end{pmatrix} \quad (3)$$

where p_{11} is the proportion of country-years in the first state, Peace for example, in period t , that remain in the same state at period $t + \tau$. This proportion is also interpreted as the probability that a peaceful country in the reference period remains peaceful in the next period. p_{12} is the proportion of country-years that change from a state of peace to armed conflict at time $t + \tau$ or the probability that a peaceful country-year in the reference period will be in a state of armed conflict in the next period; p_{13} is the proportion of country-years that transition from the Peaceful state to War.

Where the three analytical states include the post-conflict state (second case discussed above) p_{13} is the probability that a peaceful country-year moves into the post-conflict state. This does not make sense; the post-conflict status is only relevant for a country emerging from a state of war. Therefore, p_{13} is set to zero. p_{21} is the proportion of country-years that transition from Instability to Peace. The fact that Instability might be due to minor conflict, not necessarily war, implies that p_{21} could be non-zero. If Instability is due to war, p_{21} would be zero; p_{31} is the proportion of country-years moving from Post-conflict to Peace state between t and $t + \tau$.

The transition matrix P is nonnegative as each transition probability $p_{ij} \geq 0$. Therefore:

$$0 \leq p_{ij} \leq 1 \quad (4)$$

As elements of the transition matrix interpreted as probabilities, elements in each row must sum to 1.

$$\sum_{j=1}^n p_{ij} = 1 \quad (5)$$

Conceptually, in cases that include Post-conflict as the third state (with Peaceful and Instability being the other two):

$$p_{13} = 0 \quad (6)$$

2.3. Empirical transition matrices

The empirical transition matrices are reported over two periods: before and after 1989. The end of the Cold-War in 1989 was considered as ushering in a more politically complex and unstable period as the two greatest world political blocs, The West and the East, disengaged from Africa (Clough, 1992). Whether or not empirical results support the thesis that the post-Cold War period was more politically unstable is empirically shown in the results below.

First are transition matrices reflecting the case where Peace, Armed Conflict and War, are the three political states. The second set of results shows transition matrices where the three political states are: Peace, Instability, and Post-conflict.

Table 1.1 shows transitions over the full sample period (1970-2014). The last row "Total" shows the average proportion of country-years in a particular state over the sample period.

Table 1.1: Transitions over the sample period (1970-2014)

Intensity	Intensity			Total
	Peace	Armed conflict	War	
Peace	95.10	4.24	0.66	100.00
Armed conflict	27.08	60.65	12.27	100.00
War	9.40	22.15	68.46	100.00
Total	81.02	12.39	6.6	100.00

This transition matrix is noisy; all its transition probabilities are non-zero implying that mobility is observed in all directions. This implies that at period t it is impossible to determine with certainty in what state a country will be at period $t+1$. One may only make a probabilistic statement about the position of a country in one of the three states. The empirical results show that globally, 19 per cent of African country-years were in a state of instability over the period from 1970 to 2014. Low-intensity violence represented about two-thirds of this instability.

Table 1.1 shows that in spite of the fact that Africa is often characterized as a war-torn region, the continent displayed 81 per cent of peaceful country-years between 1970 and 2014. Outright war occurred in 6.6 per cent of country-years; armed conflict, a milder form of war, was experienced in 12.4 per cent of country-years. In terms of transitions, 95 per cent of peaceful country-years in the reference period remained peaceful. Twenty-seven per cent of cases of Armed Conflict became Peaceful while about 12 per cent of them became outright wars. Sixty-eight per cent of country-years in the War state remained in the same state with 22 per cent of them turning into Armed Conflict and about 9.5 per cent becoming peaceful.

This general picture does not, however, capture the changes in political instability that occurred before and after the end of the Cold War, as reported in Tables 1.2 and 1.3.

Table 1.2: Transitions during the Cold War (before 1989)

Intensity	Intensity			Total
	Peace	Armed conflict	War	
Peace	96.30	3.21	0.49	100.00
Armed conflict	25.88	57.65	16.47	100.00
War	10.81	9.46	79.73	100.00
Total	83.59	8.46	7.95	100.00

In order to determine whether the Cold War period was less unstable than the period post-1989, probabilities in transition matrix 1.2 should be compared with information in Table 1.3 capturing the post-Cold War transition probabilities.

Table 1.3: Transitions after the Cold War (after 1989)

Intensity	Intensity			Total
	Peace	Armed conflict	War	
Peace	94.20	5.07	0.72	100.00
Armed conflict	27.13	62.77	10.11	100.00
War	8.57	35.71	55.71	100.00
Total	79.00	15.69	5.31	100.00

Tables 1.2 and 1.3 appear to confirm the thesis that the post-Cold War period has been more politically unstable than the period before 1989. The probability that a country-year be in either state of political instability (Armed Conflict and War) increased from about 0.16 to 0.21 a rise of 31 per cent. The intensity of instability also changed. Whereas the probability of a country-year being in the War state was almost the same as the probability of a country-year being in Armed Conflict before the end of the Cold War, the probability of armed conflict doubled from about 0.08 to about 0.16 between the two periods. By contrast, the probability of experiencing a full-blown war declined from about 0.08 to about 0.05. This could be the result of the end of ideological wars such as those Angola, Mozambique and Ethiopia. Moreover, the probability of War country-years that ended and became Peaceful declined by 21 per cent in the post-Cold War period. A large number of wars morphed into armed conflict. The probability that a war changed into an Armed Conflict increased by a staggering 300 per cent after the Cold War from 0.09 to 0.36. This is an indication that instability reduced in intensity but milder conflict became widespread in the post-Cold War era.

In Tables 2.1 to 2.3, political instability is defined by combining armed conflict and war into one state called “Instability” as discussed earlier. The other states are Peace and Post-conflict. If a war ends and a peaceful period ensues, the latter is coded as a post-conflict state. However, if an armed conflict is followed by a peaceful period, it is coded as a Peace state. Therefore, the ten-year period following the end of a war can be coded either as post-conflict (if a country is not in a state of armed conflict) or Instability if the intensity of the violence is reduced but there is lingering armed conflict. Hence, in all matrices the third element in the Peace row is equal to zero, as set in equation (6) because no transition can be made directly from a Peaceful state to a Post-conflict state. Given how Instability is defined, the matrices below show non-zero transitions from Instability to peace, reflecting the country-years that move from the state of armed conflict to the Peace state.

Table 2.1: Transitions over the full sample period (1970-2014)

State	State			Total
	Peace	Instability	Post-conflict	
Peace	95.87	4.13	0.00	100.00
Instability	12.21	79.11	8.69	100.00
Post-conflict	9.40	13.42	77.18	100.00
Total	74.24	18.98	6.77	100.00

The pattern of mobility shown in Table 2.1 covering the full sample period may hide important differences in instability and transitions that were experienced during and after the Cold War.

Table 2.2: Transitions during the Cold War (before 1989)

State	State			Total
	Peace	Instability	Post-conflict	
Peace	96.68	3.32	0.00	100.00
Instability	11.95	81.13	6.92	100.00
Post-conflict	5.36	8.93	85.71	100.00
Total	77.50	16.41	6.09	100.00

Transitions in Table 2.2 differ from those shown in Table 2.1, suggesting that an analysis based on aggregate information covering the full sample period might miss some developments that may have been specific to Cold War and post-Cold war periods. Hence, it is more informative to compare information in Table 2.2 with information in Table 2.3 below.

Table 2.3: Transitions after the Cold War (after 1989)

State	State			Total
	Peace	Instability	Post-conflict	
Peace	95.32	4.68	0.00	100.00
Instability	12.40	77.91	9.69	100.00
Post-conflict	11.11	16.67	72.22	100.00
Total	71.65	21.00	7.35	100.00

Given the way Instability is defined in Tables 2.1 to 2.3, it is normal that the probability of a country-year being in a state of instability increases relative to probabilities in 1.1 to 1.3. What is striking in Tables 2.2 and 2.3 is the importance of cases of post-conflict country-years that either fell back into instability or became peaceful. After the Cold War, the probability that a post-conflict country-year fell back into the state of Instability nearly doubled from 0.09 during the Cold War to 0.17 after. And the probability of a country-year moving from post-conflict to the Peace state more than doubled from 0.05 before the Cold War to 0.11 after. The period after the Cold War was more unstable in terms of the number of incidences of political violence even though the intensity of the violence declined. Furthermore, after the Cold War, the probability of post-conflict country-years remaining in the post-conflict state was drastically reduced from 0.86 during the Cold War to 0.72 afterwards. This decline was the result of an increase in country-years falling into the other two states.

Therefore, the analysis of political violence as a measure of fragility needs to take into account not only the number of political violent incidents but also the intensity of violence as well as what happens after the end of a civil war. A large number of civil wars are transformed into low-level violence before their eventual termination. This highlights the need to devote more attention to the analysis of post-conflict societies given their particularities as they share characteristics with unstable and peaceful situations (Nkurunziza, 2010). As discussed earlier, the period following the end of a war could still be characterized by residual violence carried over from the war period particularly in cases of protracted wars. In fact, if this residual violence is not quickly contained, post-conflict cases can revert to the state of war suggesting that post-conflict periods require more attention than they are often accorded. The international community tends to focus on the termination of war or armed conflict, with not

enough attention devoted to the process of post-conflict reconstruction and peace consolidation (Nkurunziza, 2016a).

Understanding the intensity and dynamics of political instability is a crucial step towards a better appreciation of the impact of political fragility on socio-economic outcomes. The next Section is devoted to the issue of capital accumulation: its estimation, and its interaction with political instability.

3. Political instability and physical capital accumulation

This section briefly discusses the two hypotheses underlying the analysis of the effect of armed violence on economic performance before an exposition of the direct and indirect effects of political instability on capital accumulation. It closes with a presentation of the methodology used to estimate the stock of capital.

3.1. Armed violence and economic performance

Analyses of the effect of politically-motivated armed violence on economic performance have revolved around two hypotheses (Kang and Meernik, 2005). The first and most widely accepted is the “war ruin hypothesis” which posits that armed conflict, particularly civil war, destroys the economy and that post-conflict reconstruction is very costly and takes a relatively long time. This hypothesis could be illustrated by the case of Burundi, a country that has been torn by a cycle of civil wars since its independence in 1962 (Table 3).

Table 3: Characteristics of Burundi's internal armed conflict

<i>Characteristic</i>	<i>1965</i>	<i>1972</i>	<i>1988</i>	<i>1991</i>	<i>1993-2003</i>	<i>2015 to date*</i>
Duration (months)	2	4	2	1	120	27
Deaths (thousands)	5	200	15	1-3	300	1.2
Refugees (thousands)	0	300	50	38	687	416
Deaths & refugees to population (%) ^b	0.2	14.0	1.3	0.7	17.1	3.8
Years from previous conflict	—	6	16	3	2	12
Provinces affected	Muramvya	Whole country	Ngozi, Kirundo	Cibitoke, Bubanza, Bujumbura	Whole country	Whole country but mostly Bujumbura

Source: Nkurunziza (2016b); Data in the last column (2015 to date) reflects the latest available information. Data on total deaths is from ACLED (2016), effective April 2016; information on the number of refugees is from UNHCR, at (<https://data2.unhcr.org/en/situations/burundi>), effective July 2017.

The deadliest and economically costliest episode was the ten-year 1993-2003 civil war. The average rate of economic growth between 1970 and 1992 was 4.2 per cent per year, dropping to 1.5 per cent per year in the period from 1993 to 2014. From the beginning of the war in 1993 until 2000, the annual rate of economic growth was negative, save for the year 1998. It is also worth noting that the rate of economic growth in 1972 was -6.4 per cent as a result of the first large-scale violence that took place across the country. The effect of war on the economy was relatively modest in 1988 and 1991 due to the fact that violence was confined to some parts of the country and lasted for a relatively short period of time. Most recently in 2015, due to political instability, Burundi's economy contracted by 4 per cent (IMF, 2016).

The second hypothesis is that wars can lead to the “phoenix factor” whereby devastated economies are transformed into more efficient and competitive systems thanks to a process of post-conflict rebuilding that uses better resources and the most up to date technologies. The

same hypothesis assumes that post-conflict settings are characterized by better governance systems that are less prone to the burden of pre-war interest groups.

The "phoenix factor" hypothesis, which is inspired by the experience of the economic boom that followed World War II during Europe's reconstruction, might sound intuitive but its relevance to Africa is rather disputable. In reality, it is rare that civil wars in Africa end with sweeping changes to the pre-war institutional order. Moreover, wars destroy wealth and occur in countries that have a limited access to the resources needed for post-conflict reconstruction. In fact, for a long period of time, most of these countries continue to rely on external assistance to have functioning governments and fund part of their post-conflict reconstruction. Ndikumana (2016) finds that post-conflict countries generally receive more aid in the five years following the end of the conflict than during the conflict. Empirical testing of the two hypotheses has tended to support the "war ruin hypothesis" (Kang and Meernik, 2005).

The economic revival of Rwanda post-1994 could be considered as a relevant illustration of the "phoenix factor." The country experienced genocide in 1994 where about one million persons perished in a relatively short period of time. The economy collapsed, contracting by 50 per cent in 1994. The recovery was swift: the following year, the rate of growth was 35 per cent. And in subsequent years, economic growth accelerated. Whereas Rwanda's average rate of economic growth during the period from 1970 to 1993 was 3.2 per cent, it jumped to 9.7 per cent per year, on average, over the period following the genocide, from 1995 to 2014. Maintaining such a high rate of economic growth for such a long period required leadership.

Within Africa, the case of Rwanda might be considered as exceptionally fitting the "phoenix factor" concept for at least two reasons. First, the total destruction of the country's administrative and institutional system meant that reconstruction had to start from scratch, with assistance from the international community. The institutional destruction experienced in Rwanda over such a short period of time was unprecedented in Africa. It was probably easier to start from scratch than mend the failing system that had led to genocide. Secondly, the leadership tasked with the reconstruction process was not connected to the old elite that had been completely routed. This minimized the deleterious effect of opposition to reform that is usually exerted by vested interests of the governing elites in developing countries (Ngaruko and Nkurunziza, 2006). These two conditions have historically been rare in other cases of post-conflict reconstruction in Africa. This in no way implies that Rwanda could not have followed a different path. Credit must be given to Rwanda's leadership that enabled the country to achieve these results. As Hoeffler et al. (2010) find sustained growth in post-conflict societies is robustly associated with good governance.⁵

On the negative effects of civil wars on economic performance, Collier (1999) identified five major channels through which civil wars affect the economy: destruction of capital, socio-economic disruptions, diversion of resources to non-productive uses, dissaving, and portfolio substitution. These channels show that wars and other forms of armed violence negatively affect capital accumulation both directly and indirectly.

⁵ A non-academic discussion of economic leadership in Rwanda is provided by Crisafulli and Redmond (2012).

3.2. Direct effect of political instability on capital accumulation

The direct effect relates to the destruction of capital during periods of armed conflict and the reallocation of resources traditionally devoted to investment to non-productive uses, such as supporting the war effort. In many conflicts, particularly civil wars where relatively strong belligerents fight against government forces, destruction of physical capital is an integral part of the fighting strategy. Infrastructure including bridges, hospitals, and schools is destroyed by rebels either because they are considered as state symbols or because such destructions are expected to slow the advance of the enemy. In Angola for example, it was estimated in 2006 that just restoring the infrastructure destroyed during the war that ended in 2002 would cost the country about \$35 billion.⁶ In addition to the destruction of productive capital, belligerents usually lay mines along roads and in fields, making productive land inaccessible even several years after the war has officially ended. For example, Mozambique was declared mine-free only in 2015, twenty-two years after the end of the civil war.⁷ Angola is still clearing its mines.

Civil wars are very costly. Governments in war-prone countries divert resources from productive uses such as investment to war and security-related services, penalizing the economy. Collier and Hoeffler (2006) estimated direct costs associated with countries' involvement in armed violence. Controlling for other factors, countries at civil war spend an additional 1.8 per cent of their GDP on the military. Spending on the military increases to 2.5 per cent of GDP for countries involved in an international war. Moreover, past involvement in an international war induces additional military spending of 1.3 per cent of GDP.

These additional costs are resources that are diverted from other uses, including public investment. The data on the share of the real gross fixed capital formation to real GDP, which is used to proxy for investment, shows a significant difference in the investment level between peaceful periods and periods of civil war. The average value of investment to GDP ratio for peaceful country-years is 20 per cent whereas the corresponding value for country-years in civil war is 16 per cent. A test for the equality of the two means strongly rejects the null hypothesis of equality, meaning that they are statistically different.

3.3. Indirect effect of political instability on physical capital accumulation

There are several indirect channels through which political instability affects physical capital accumulation. They include disruptions to economic activity, dis-saving, portfolio substitution, and macroeconomic instability.

Armed conflict creates insecurity that slows down economic activity. In Burundi, for example, the insecurity that started in April 2015 following the sitting president's decision to seek a third term in office, which many opposed through demonstrations, forced many businesses to close down. A number of investors fled the country dealing a blow to the economy. Public and private investment suffered from this climate of insecurity coupled with economic decline.

At the microeconomic level, economic agents affected by adverse political and economic environment during times of political conflict rely on their savings to survive. Firms absorb their losses by using saved profits while households who become unable to earn a regular income—for example refugees-- rely on their personal savings or become destitute. This process could lead to general dis-saving, eroding a country's capacity to invest. It has also been

⁶ <http://reliefweb.int/report/angola/angola-restoring-destroyed-infrastructures-estimated-usd-35-billion>

⁷ <https://www.halotrust.org/media-centre/news/halo-trust-leads-the-way-to-mine-free-mozambique/>

suggested that countries experiencing political difficulties engage in capital flight, another form of dis-saving. In fact, more than economic risk and policy variability, political instability has been empirically found to be the most important factor associated with capital flight in developing countries (Le and Zak, 2006). In turn, capital flight robs the domestic economy of its capacity to invest particularly in a region where investable funds are limited even in peaceful times. Political instability has also been found to accentuate the negative effect of irreversibility on investment behavior of firms in Africa (Bigsten et al., 2005).

Political instability also creates uncertainty and economic instability that induce economic agents to flee from the domestic currency, discouraging domestic investment and capital accumulation. When the government of Burundi increased inflationary tax to fund the war effort as a result of the loss of traditional sources of revenue in the 1990s and early 2000s, economic agents reacted by fleeing from the domestic currency in order to avoid predatory taxation. They switched to foreign currency denominated assets, transferred their assets abroad, or over-invested in non-productive sectors, particularly real estate. The flight from domestic currency was illustrated by a threefold increase in the long-run semi-elasticity of inflation to demand for real money in circulation before and after the eruption of civil war in October 1993 (Nkurunziza, 2005). More recently, the strong demand for foreign currency in the country following the onset of the current political crisis in April 2015 may also be interpreted as an indication of economic agents' flight from domestic currency.⁸ These examples suggest that in times of political instability, economic agents are more preoccupied with protecting their assets rather than making new investments.

3.4. Computation of the stock of capital

This section focuses on the computation of the stock of capital, a methodology used for all the countries in the sample, covering the period from 1970 to 2014. This data is generated using the perpetual inventory method and following closely Nkurunziza (2014). Starting from the canonical investment stock equation where K is capital stock, δ the rate of depreciation of capital, $0 < \delta < 1$, I investment, and subscripts i and t represent country and year, respectively:

$$K_{it} = K_{it-1} - \delta K_{it-1} + I_{it} \quad (7)$$

The lagged value of the stock of capital may be expressed as:

$$K_{it-1} = K_{it-2} - \delta K_{it-2} + I_{t-1} \quad (8)$$

Substituting past values of capital stock in equation (7) and solving backwards until the initial period of the sample yields the perpetual inventory equation (Nehru and Dhareshwar, 1993):

$$K_{it} = (1 - \delta)^n K_{i0} + \sum_{t=0}^{n-1} I_{i,n-t} (1 - \delta)^t \quad (9)$$

where n is the number of years of observation and K_{i0} is the initial stock of capital. Some countries might have negative rates of capital accumulation either because they destroy existing capital or when their annual spending on investment is too low to account for the depreciation of the existing stock of capital. These two effects are often combined during periods of political instability. Since $0 < \delta < 1$:

⁸ According to data from Burundi's central bank (<http://www.brb.bi/fr/content/monnaie-et-cr%C3%A9dit>), at the end of August 2016, the stock of foreign reserves held at the central bank had dropped by 69 per cent relative to its level at the end of March 2015, just before the beginning of the latest political crisis.

$$\lim_{n \rightarrow \infty} (1 - \delta)^n K_{i0} = 0 \quad (10)$$

Equation (10) implies that the first part of the term in the right-hand side of equation (9) has declining influence on the determination of the total stock of capital as time passes. Using an annual rate of depreciation of 5 per cent, as is the norm, one dollar of capital stock at the beginning of the sample period in 1970 was worth about \$0.10 at the end of the sample period in 2014. Therefore, when measured towards the end of the sample period, the values of the stock of capital excluding the effect of initial capital are close to the values of the total stock of capital.

Different methods have been used to estimate the stock of initial capital, but they suffer from severe limitations especially when they are applied to African economies.⁹ This paper adopts the following method to estimate the initial stock of capital. First, we build a series of capital stock using the second part of the right-hand side of equation (9). Then, we compute the median coefficient of capital share to GDP for the period 2010-2014. As discussed above, these estimated coefficients are close to the true coefficients of total capital stock share to GDP.¹⁰ Assuming that this median share is fixed, it is then multiplied by the value of GDP at the beginning of the sample period (1970 for most countries) to generate an estimate of initial capital stock. Then an annual series capturing the effect of initial capital on the total stock of capital is constructed using the formulae in the first part of the right-hand side of equation (9). Finally, the two series computed on the basis of equation (9) are added to get the total stock of capital.

Interacting political states with the variable representing the growth of the stock of capital, which is a proxy for capital accumulation, illustrates differences in capital accumulation across countries and political states. Moreover, correlating capital accumulation with economic growth shows the extent to which these two variables interrelate. This statistical analysis sheds light on some of the reasons why some countries emerge out of states such as war with high and sustained rates of economic growth while others fail. For example, looking at the rate at which countries at war destroy their capital relative to countries in the peaceful state, which accumulate capital, provides some idea of the opportunity cost of political instability.

4. Data sources and empirical results

Using the empirical data on capital accumulation computed using the methodology discussed above, we present the pattern of capital accumulation across time, countries and political states, before shifting the focus on the correlates of capital accumulation in the last part of the Section.

4.1. Discussion of the data and their sources

Macroeconomic variables used in this paper are from the following sources: GDP and gross fixed capital formation, the proxy used for investment, both in current dollars are from UNCTADStat, UNCTAD's data base. They cover the period from 1970 to 2014. Real income and real investment are calculated using the US GDP deflator, with 2010 as base year. This latter variable is from the World Bank's World Development Indicators. We could not access disaggregated information on private and public investment in order to compare the processes of private and

⁹ See Nkurunziza (2014) for details.

¹⁰ This is to avoid basing the calculation on a one-year observation which could be an outlier or simply missing. Moreover, taking the median value over a longer period (e.g. 2000-2014) would introduce a stronger bias in the result as equation (10) shows.

public capital accumulation. Indeed, as Pritchett (2000) rightly cautions, whereas the accumulation of depreciated private investment could be considered as a good approximation of the stock of private capital, it is difficult to credibly make a similar assumption for public capital. Spending on public investment, which is what the public investment variable measures does not necessarily result in economically valuable capital. This is particularly the case in some African countries where white elephant projects have absorbed important resources.

While this caveat on data quality needs to be kept in mind when interpreting the results based on the stock of capital computed following the methodology in Section 3.4, the problem identified by Pritchett is not expected to significantly affect the analysis in this paper. We are not using the stock of capital as our analytical variable. Our analysis is more about the pattern of spending on investment, and how this pattern changes across the different political states discussed earlier. The variable used throughout the analysis is the rate of capital accumulation not the level of capital stock.

Data on public investment used in the later part of this paper (ratio of public investment to GDP) is from the World Bank's Africa Development Indicators. It reduces the sample size as its coverage starts in the 1980s or even 1990s for most African countries and ends in 2011. All the other variables are from the World Bank's World Development Indicators, covering the period from 1970 to 2014, even though coverage is unequal across countries. These are: the rate of economic growth, the ratio of debt to GDP, the ratio of FDI to GDP, and the ratio of ODA to GNI.¹¹

Information used to construct the indicators of political instability are from UCDP/PRIO Armed Conflict Dataset (see UCDP/PRIO, 2015), as discussed in Section 2.

4.2. Pattern of capital accumulation

Differences in country experiences of capital accumulation as illustrated in Table 4 below indicate that spending on investment fluctuates over time as a result of the economic and political environment prevailing at specific times.

Table 4: Annual growth rates of the stock of capital over time, 1970-2014 (percentages)

Countries	1970-2014	1970s	1980s	1990s	2000s	2010-2014
Algeria	5.27	12.42	6.40	-0.64	1.89	6.85
Angola	2.37	2.98	1.02	1.05	10.11	11.61
Benin	4.33	4.16	1.02	4.36	4.60	6.30
Botswana	6.99	10.13	8.03	7.25	6.55	7.77
Burkina Faso	3.90	1.86	4.20	2.63	3.62	9.63
Burundi	1.87	0.92	5.01	-0.56	-0.40	3.77
Cabo Verde	3.23	5.06	1.77	3.24	5.71	3.48
Cameroon	3.51	8.26	5.42	-0.66	2.06	4.23
Central African Republic	1.55	3.63	2.16	0.75	-0.22	2.92
Chad	2.32	2.48	-1.33	0.98	10.97	5.93
Comoros	2.24	11.37	4.11	1.01	0.16	-1.08
Congo	4.84	5.48	4.48	1.30	3.97	11.81
Côte d'Ivoire	0.81	11.06	-0.16	-0.77	-0.23	2.89

¹¹ Tax to GDP ratio variable was dropped due to limited data availability.

Dem. Rep. of the Congo	-0.72	8.86	-1.18	-3.57	-2.03	1.89
Djibouti	3.34	0.96	4.89	2.66	1.70	6.85
Egypt	3.91	4.45	3.92	4.14	2.90	5.46
Equatorial Guinea	10.10	1.96	1.50	19.83	21.93	18.54
Ethiopia	1.88	0.31	3.22	0.37	4.31	14.97
Gabon	3.28	8.68	3.28	-0.27	1.42	5.24
Gambia	1.54	-0.12	0.19	3.58	2.03	0.40
Ghana	1.40	-2.32	-1.96	3.67	6.52	11.43
Guinea	2.15	0.20	0.82	3.13	2.42	4.42
Guinea-Bissau	-0.92	1.45	0.31	-1.31	-3.54	-2.79
Kenya	2.45	4.91	2.04	1.00	2.38	7.28
Lesotho	3.94	4.65	5.79	7.53	0.21	3.47
Liberia	0.75	7.32	-0.88	-3.66	-2.93	5.87
Libya	1.86	7.88	1.53	-1.62	3.47	0.30
Madagascar	1.25	2.20	-0.98	-0.48	3.76	2.30
Malawi	1.17	5.43	0.26	-0.72	-0.20	1.33
Mali	4.44	6.14	4.59	3.90	3.50	7.78
Mauritania	1.87	7.69	1.55	-1.46	4.46	10.04
Mauritius	5.24	11.70	3.60	6.74	4.06	4.63
Morocco	3.07	7.04	2.01	2.68	4.37	4.88
Mozambique	-0.47	0.66	-2.04	-2.04	0.09	8.64
Namibia	3.42	5.30	-0.63	1.71	4.03	6.90
Niger	0.55	6.08	0.27	-1.40	2.76	9.58
Nigeria	0.15	11.62	-1.21	-3.59	-1.46	5.97
Rwanda	5.38	6.38	6.46	0.33	2.69	10.82
Sao Tome and Principe	0.07	-1.82	-0.62	5.99	-0.31	7.53
Senegal	2.51	2.13	1.86	2.33	4.22	4.91
Seychelles	5.55	8.36	4.69	6.13	3.26	4.98
Sierra Leone	0.99	2.05	0.52	-2.25	0.70	12.03
South Africa	3.00	6.35	2.08	1.07	2.99	3.96
Sudan	5.06	6.22	3.41	1.24	9.12	7.57
Swaziland	2.72	9.95	1.95	2.73	1.66	2.19
Togo	1.19	7.67	0.99	-1.37	1.07	6.75
Tunisia	3.32	9.40	3.19	3.32	2.96	2.42
Uganda	2.62	3.64	-1.57	2.07	4.66	6.78
United Republic of Tanzania	2.91	4.92	1.75	-0.32	2.74	7.18
Zambia	0.58	11.79	-1.14	-0.40	6.54	13.06
Zimbabwe	-0.16	-1.35	-0.77	0.26	0.79	9.68
Median	2.61	4.70	1.71	1.14	2.33	5.93

The pattern of capital accumulation shown in Table 4 unveils several facts that are worth highlighting. First, on the whole, African countries display low levels of capital accumulation. The median of 2.61 is low, particularly considering that most countries started with a very low initial capital at independence in the 1960s. For comparison, in a study using a sample of 88 countries and covering the period from 1960 to 1994, the group of African countries had an average annual rate of capital accumulation of 4.8 per cent, the lowest of all developing regions. The rates were 9.9 for East Asia, 7.1 for the Middle East, and 5.4 for Latin America (Collins and Bosworth, 1996). Bosworth and Collins (2003) confirm that capital accumulation was the key to the successful growth experience of East Asian economies. For most of the period since the 1980s, East Asia's rate of investment has been about twice that of Sub-Saharan Africa, suggesting that African countries will need to substantially scale up their rates of capital accumulation in order to deliver high and sustainable rates of economic growth.

Second, over the long-term, there are very few countries that have consistently accumulated capital. More than half of the countries in the sample destroyed capital (negative growth rates) in at least one of the five periods shown in Table 4.

Third, political fragility seems to be strongly associated with low capital accumulation. Countries with the most emblematic wars in Africa, including Algeria in the 1990s, Angola from the 1970s to the early 2000s, Burundi in the 1990s, the Democratic Republic of Congo in the 1990s and 2000s, Mozambique in the 1970s and 1980s, and Uganda in the 1980s post very low, mostly negative rates of capital accumulation, during these periods of political fragility. In this regard, Table 4 illustrates more clearly the negative correlation between political fragility and capital accumulation.

Fourth, for most countries, the 1970s were the best period for capital accumulation. At an average annual rate of growth of capital stock close to 5 per cent for the 51 African countries in the sample, many countries emerging from independence showed a remarkable performance in terms of capital accumulation relative to the following three decades. Information in Table 4 illustrates why the 1980s and 1990s have been termed as "lost decades" in Africa (Easterly, 2001). The 2000s, in turn, recorded an improvement in capital accumulation with the doubling of the sample median relative to the previous decade.

Fifth, the most recent period shows the fastest rate of capital accumulation but statistics are based on just 5 observations per country. For most countries, the rates of capital accumulation between 2010 and 2014 are consistently higher than those of earlier periods and there is no reason to suspect that this might be due to the limited number of observations. Surprisingly, this post-commodity boom period has been challenging for many African countries that saw their export revenues drop sharply. Should this trend be sustained, Africa might be "bouncing back after several lost decades" (Devarajan and Fengler, 2013, page 70). Stronger capital accumulation could help the continent to build a growth model more rooted in the domestic economy that will be less prone to the vagaries of international commodities markets.

4.3. Capital accumulation across political states

As political states change over time for many countries, conditioning capital accumulation on different political states illustrates the relative cost of political instability in African economies (Table 5).

Table 5: Annual rate of capital accumulation by political states (percentages)

Intensity of political instability	median	Observations
Peace	2.86	1818
Armed conflict	2.13	278
War	0.86	148
Political States		
Peace	2.91	1666
Instability	1.66	426
Post-conflict	2.00	152

Not surprisingly, capital accumulation is fastest in peaceful periods and declines with the intensity of political violence. The first panel of Table 5 shows that capital accumulation during armed conflict does not substantially differ from its values during peaceful periods. In contrast, capital accumulation in war periods is only 30 per cent of the rate in peaceful times. Averages hide differences across countries and over time. A number of countries experienced several years of negative growth rates of capital accumulation, implying that they were destroying rather than adding to their capital stocks. This was the case with Algeria in the 1990s, Burundi between 1994 and 2004, the Democratic Republic of Congo and Guinea Bissau for most of the sample period, and Mozambique until 2004. The data in the sample show that the coefficient of correlation between capital accumulation and the intensity of political instability is -0.12 and it is highly statistically significant.

The large majority (18 out of 24, or 75 per cent) of countries with high rates of capital accumulation, namely those with annual growth rates of capital greater or equal to the median, did not experience long episodes of political instability. Only Sudan combines a strong rate of capital accumulation and severe political fragility (civil war). This seems to illustrate the positive correlation between political stability and capital accumulation. Other correlates of capital accumulation are discussed in the next Section.

It would be misleading to conclude that negative capital accumulation is experienced only in countries with severe political instability such as civil wars. Several African countries that have not experienced long periods of civil war also post several years of capital destruction. They include Côte d'Ivoire, Ghana, Libya even before the beginning of its turmoil in 2010, Malawi, Mauritania, Niger, Sao Tome and Principe, Togo, Zambia and Zimbabwe. The fact that capital destruction is not necessarily the result of political instability as measured in this paper implies that there are more than political factors that explain capital accumulation. For example, macroeconomic instability has been found to negatively affect foreign direct investment (Chenaf-Nicet and Rougier, 2016) and hence capital accumulation.

In the second panel of Table 5, the rate of capital accumulation is lowest in countries that are in the Instability political state, although the growth rate is the double of the corresponding one in

the first panel. This is due to the way Instability in the second panel is defined, as it includes armed conflict, a milder form of political instability whose effect on capital destruction is rather limited as shown in the first panel of Table 5.

4.4. Correlation and Granger-causality between capital accumulation and economic growth

Several studies have analyzed the determinants of investment both in Africa and elsewhere (e.g. Ndikumana, 2000). So, in this section, the objective is to identify some correlates of capital accumulation, taking into account the three political states. This should help to identify the factors explaining why countries might display different patterns of capital accumulation and different rates of economic growth over time. Table 6 shows the correlations between capital accumulation and the rate of economic growth, as well as Granger-causality tests between capital accumulation and economic growth.

Table 6: Correlations coefficients and Granger-causality tests between capital accumulation and economic growth

Countries	Correlation	Growth of capital stock (%)	Economic growth (%)	Granger-causality tests	
				Capital to growth	Growth to capital
Algeria	0.27*	5.27	3.70	0.05**	0.07*
Angola	0.40**	2.37	4.80	0.16	0.51
Benin	0.19	4.33	4.22	0.88	0.38
Botswana	0.56***	6.99	8.28	0.90	0.00***
Burkina Faso	0.02	3.90	4.48	0.40	0.59
Burundi	0.31**	1.87	3.47	0.23	0.00***
Cabo Verde	0.07	3.23	6.32	0.38	0.84
Cameroon	0.39***	3.51	4.06	0.07*	0.00***
Central African Republic	0.13	1.55	1.98	0.20	0.96
Chad	0.36***	2.32	3.27	0.04**	0.65
Comoros	0.05	2.24	2.33	0.93	0.21
Congo	0.47***	4.84	0.76	0.20	0.19
Côte d'Ivoire	0.25*	0.81	3.98	0.01***	0.00***
Dem. Rep. of the Congo	0.49***	-0.72	2.39	0.01***	0.01***
Djibouti	0.38*	3.34	2.89	0.98	0.05**
Egypt	0.63***	3.91	4.68	0.49	0.03**
Equatorial Guinea	0.49***	10.10	8.81	0.12	0.93
Ethiopia	0.40**	1.88	8.23	0.19	0.04**
Gabon	0.57***	3.28	3.95	0.87	0.12
Gambia	-0.08	1.54	3.63	0.55	0.49
Ghana	0.61***	1.40	4.70	0.00***	0.5
Guinea	-0.09	2.15	3.65	0.34	0.95
Guinea-Bissau	0.14	-0.92	3.20	0.11	0.28
Kenya	0.43***	2.45	4.19	0.63	0.24
Lesotho	0.02	3.94	4.23	0.99	0.98
Liberia	0.32**	0.75	2.92	0.60	0.39
Libya	0.17	1.86	3.68	0.04**	0.73
Madagascar	0.29**	1.25	2.10	0.20	0.57

Malawi	0.26*	1.17	4.70	0.82	0.13
Mali	0.04	4.44	6.14	0.65	0.01***
Mauritania	0.19	1.87	2.99	0.13	0.58
Mauritius	0.06	5.24	4.45	0.08*	0.04**
Morocco	0.13	3.07	4.71	0.76	0.42
Mozambique	0.17	-0.47	7.00	0.66	0.23
Namibia	0.33**	3.42	3.43	0.40	0.02**
Niger	0.32**	0.55	3.00	0.11	0.13
Nigeria	0.01	0.15	4.89	0.45	0.10*
Rwanda	0.18	5.38	6.00	0.89	0.54
Sao Tome and Principe	-0.09	0.07	4.48	0.47	0.52
Senegal	0.11	2.51	3.68	0.65	0.24
Seychelles	0.29**	5.55	4.92	0.59	0.24
Sierra Leone	0.36***	0.99	3.35	0.00***	0.85
South Africa	0.27*	3.00	2.95	0.95	0.14
Sudan	0.16	5.06	5.41	0.32	0.81
Swaziland	0.08	2.72	3.06	0.50	0.08*
Togo	0.51***	1.19	5.26	0.10*	0.00***
Tunisia	-0.00	3.32	2.52	0.80	0.55
Uganda	0.21	2.62	4.70	0.08*	0.00***
Tanzania	0.04	2.91	6.35	0.85	0.94
Zambia	0.57***	0.58	4.51	0.00***	0.05**
Zimbabwe	0.28*	-0.16	2.63	0.75	0.58
Median	0.33***	2.61	4.00	----	----

Note: ***, **, and * are significance levels at one, five and ten per cent, respectively. In the last two columns, the values are asymptotic Chi-squared probability values at one degree of freedom.

The majority of countries have strong, positive and significant coefficients of correlation between capital accumulation and economic growth. Hence, for most African countries, economic growth is associated with capital accumulation, as is the case elsewhere in the developing world. As shown earlier in Table 4, capital accumulation increased during the post-2000 period relative to the 1980s and 1990s. The post-2000 period was characterized by a commodity boom from 2003 to 2011 (Nkurunziza and Tsowou, 2015)¹² during which both capital accumulation and economic growth accelerated from the levels observed over the previous two decades. During the commodity boom, the median annual rate of economic growth was 4.9 per cent and for capital accumulation, it was 4.1 per cent; both rates of growth are higher than the full sample medians.

In order to further explore the meaning of these correlations, a Granger-causality test is performed country by country. Indeed, the economics literature predicts that aggregate output -and hence economic growth-- is a function of the stock of capital, as formulated in the classical Cobb-Douglas production function, for example. This suggests that the rate of growth of the stock of capital Granger-causes the rate of economic growth. It is also theoretically plausible that the growth of the stock of capital or capital accumulation depends on the health of an

¹² Nkurunziza and Tsowou (2015) econometrically dated the period of the boom as starting in July 2003 and ending in April 2011.

economy, proxied by the rate of economic growth. Indeed, there is empirical evidence establishing that spending on domestic investment in Sub-Saharan Africa, the main determinant of capital accumulation, is a function of income growth (Ndikumana, 2000).

The direction of causality between the two variables is empirically established through the Granger-causality test (see results in the last two columns of Table 6). The column with the heading "Capital to growth" shows the results of the test of the hypothesis that the rate of capital accumulation Granger-causes the rate of economic growth. The reported results are asymptotic Chi-squared probability values based on the null hypothesis that the rate of capital accumulation does not Granger-cause the rate of economic growth. The last column shows the results for reverse Granger-causality test: the hypothesis is that the rate of economic growth Granger-causes the rate of capital accumulation. For most countries, the results are based on the period from 1970 to 2014. This implies 43 observations due to the loss of two degrees of freedom through the computation of the rate of growth of the stock of capital and the adoption of one lag in the Granger-causality equation.

The results illustrate the complexity of the relationship between capital accumulation and economic growth. First, there are 12 countries where capital accumulation appears to significantly Granger-cause economic growth.¹³ These countries are Algeria, Cameroon, Chad, Côte d'Ivoire, Democratic Republic of Congo, Ghana, Libya, Mauritius, Sierra Leone, Togo, Uganda and Zambia. This list is dominated by mineral-rich countries. This list also comprises politically stable countries such as Mauritius, Togo and Zambia, as well as politically unstable countries such as Algeria, Democratic Republic of Congo, and Sierra Leone.

Second, there are more countries where Granger-causality runs from economic growth to capital accumulation. Indeed, for 17 countries, economic growth appears to Granger-cause the rate of capital accumulation. These countries are Algeria, Botswana, Burundi, Cameroon, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Egypt, Ethiopia, Mali, Mauritius, Namibia, Nigeria, Swaziland, Togo, Uganda and Zambia. This relationship indicates that countries increase their stock of capital when they experience high rates of economic growth. This could help to explain why Africa recorded low rates of capital accumulation during the 1980s and 1990s, the so-called lost decades for the development of the continent. In contrast, capital accumulation accelerated during the commodity boom, probably as a result of a commodity-induced process of high economic growth.

Third, eight countries are characterized by bilateral Granger-causality: capital accumulation Granger-causes economic growth, and vice versa. These countries are Algeria, Cameroon, Côte d'Ivoire, Democratic Republic of Congo, Mauritius, Togo, Uganda, and Zambia. Bilateral causality should be expected in view of the causality mechanisms explained above. Attempting to explain why a specific country falls in one of the three groups identified on the basis of information in Table 6 is beyond the remit of this paper. Nevertheless, these contrasting results echo a behavioral pattern observed at the microeconomic level: there are investors who forego spending and invest in order to create more wealth in future and those who invest only what is left after spending. Experience in Africa suggests that most countries should sacrifice some

¹³ We use the ten per cent probability value as the cut-off level of significance.

types of spending and favour investment with a view to building a basis for a more sustainable spending model in the future.¹⁴

There are countries for which we do not find a statistically significant correlation or Granger-causality relationship between economic growth and capital accumulation. It would be unwise to interpret this result as meaning that, in reality, capital accumulation and economic growth are unrelated in those countries. The absence of a correlation or statistical relationship could be due to the issues associated with the measurement of capital, as discussed in Section 4.1 (Pritchett, 2000). Indeed, if recorded spending on investment poorly reflects the creation of capital, which is the variable more directly related with output and economic growth, spending on capital would appear to be loosely connected with economic growth. It would be interesting to explore in some detail whether this group of countries shares some specific characteristics, for example if governance in these countries is poorer than in countries where accumulated spending on investment is strongly associated with economic growth. A cursory look at the World Bank's 2015 CPIA data on Transparency, Accountability and Corruption in Public Sector shows that about half (8 out of 17) of the countries for which capital accumulation does not seem to be correlated with economic growth have scores that are below the Sub-Saharan Africa average of 2.7 out of 6. A detailed discussion of this issue is beyond the objective of this paper but could potentially be a relevant extension of the current analysis.

The next step is to explore what could be the main correlates of capital accumulation in a multivariate setting. Both domestic and external factors could be correlates of capital accumulation. Domestic factors could include tax revenue as a source of public investment, economic performance measured by income growth, and the overall state of fragility of a country as measured by the indicators discussed earlier. External factors could include variables such as the flow of foreign direct investment, external debt, and external aid.

Aid could affect positively or negatively capital accumulation. The positive effect of aid on capital accumulation could be direct where a substantial part of external aid is directly allocated to investment. The indirect effect of aid on capital accumulation could be through the strengthening of mechanisms and institutions that foster capital accumulation. For example, donors often assist African countries emerging from conflict in strengthening their revenue collection institutions in order to boost their resource base and, in the long-run, reduce dependence on external assistance. The negative effect of aid on capital accumulation could be through the aid dependency syndrome. A country that is too dependent on aid might neglect other sources of investment financing, such as domestic taxes to finance public investment, and foreign direct investment. The dependence of investment on a single source of funding that is highly volatile might harm investment. Therefore, the effect of aid on capital accumulation is an empirical issue.

Table 7 presents the summary statistics of the variables used in the regressions estimated to identify the correlates of capital accumulation in Africa.

¹⁴ Warren Buffett, the billionaire, famously advised: "Do not save what is left after spending, but spend what is left after saving."

Table 7: Summary Statistics

Variables	Mean	Median	Observations
Growth rate of capital stock (%)	3.50	3.00	2244
Armed conflict (AC)	0.12	0.00	2295
War	0.06	0.00	2295
Instability	0.19	0.00	2295
Post-conflict	0.07	0.00	2295
Peaceful state	0.81	1.00	2295
Peaceful state with post-conflict	0.74	1.00	2295
Economic rate of growth (%)	4.08	4.00	2072
Debt to GDP (%)	73.87	51.29	1907
FDI to GDP (%)	3.30	1.23	1929
ODA to GNI (%)	10.77	8.03	2025
Public investment to GDP (%)	8.06	7.03	1430
Tax to GDP (%)	18.19	16.58	589

Note: "Peaceful state with post-conflict" is the second Peace state in the second panel of Table 5.

There are important differences in sample sizes across the different variables. Data on tax revenue to GDP is scanty; only 589 observations are available. It is included in Table 7 as it is potentially an important correlate of capital accumulation but it is not used in the regressions due to the important loss of degrees of freedom this would entail. For some variables, including the debt to GDP and ODA to GNI, means and medians are substantially different, suggesting that their distributions are non-normal. This should be kept in mind when interpreting the results of the regressions summarized in Table 8.

Table 8: Some correlates of capital accumulation: war and armed conflict states

Variables	Fixed effects	Fixed effects
War	-2.04***	-2.23***
Armed conflict	-0.46	-0.42
Economic growth	0.11***	0.07***
Debt to GDP in percentage	-0.02***	-0.02***
FDI to GDP in percentage	0.12***	0.11***
ODA to GNI in percentage	0.01	-0.03**
Public investment to GDP (%)		0.21***
Constant	3.75***	2.53***
R-squared	0.21	0.26
Observations	1696	1251

***, **, * are significance at 1, 5 and 10 percent probability level, respectively, based on White (1980) heteroscedasticity-consistent standard errors. The omitted category for dummy variables representing political states is the peaceful state.

The results in Table 8 should be interpreted with caution. They should be understood as correlations not causality in view of a potential problem of endogeneity between capital accumulation and its correlates that we do not intend to discuss in this paper. The two columns of Table 8 differ from the fact that the second regression includes Public investment, which reduces the sample from 1696 to 1251 observations.

Generally, the results show a strong correlation between capital accumulation and its correlates. As expected, wars have a negative effect on the rate of capital accumulation. Relative to peaceful periods, capital accumulation in war periods declines by a rate of 2.2 per cent per year, when controlling for other correlates. By contrast, the result that armed conflict does not seem to significantly affect the rate of capital accumulation seems to confirm our earlier argument that the intensity of political fragility matters for the speed at which capital accumulates.

As expected, economic growth and FDI are positively associated with capital accumulation. The finding that public investment seems to be positively and strongly associated with capital accumulation indicates that increasing public investment should be a key component of the strategy to raise the stock of capital in Africa at levels that will accelerate economic growth. The stock of debt to GDP shows a negative relationship with capital accumulation. This could be through the crowding out effect of debt servicing; servicing a large stock of external debt diverts resources that could be used for productive investment. The aid variable shows a negative association with capital accumulation, which seems to confirm the "aid dependence" hypothesis discussed above.

Table 9: Some correlates of capital accumulation: war and post-conflict states

Variables	Fixed effects	Fixed effects
War	-0.76	-1.15*
Post-conflict	0.46	-1.09*
Economic growth	0.11***	0.08***
Debt to GDP in percentage	-0.02***	-0.02**
FDI to GDP in percentage	0.12***	0.10***
ODA to GNI in percentage	0.01	-0.02*
Public investment to GDP (%)		0.21***
Constant	3.71***	2.67***
R-squared	0.22	0.25
Observations	1696	1251

***, **, * are significance at 1, 5 and 10 percent probability level, respectively, based on White (1980) heteroscedasticity-consistent standard errors. The omitted category for dummy variables representing political states is the peaceful state.

The difference between Table 8 and Table 9 is the inclusion of the post-conflict variable in Table 9 as a regressor. Generally, the results in Table 9 are similar to the previous ones in Table 8.

Economic growth, FDI and domestic public investment seem to be positively and significantly correlated with the rate of capital accumulation. The magnitudes of these correlations are comparable in both tables. Moreover, debt to GDP and ODA to GNI variables, are negatively and generally significantly correlated with the rate of capital accumulation.

However, there are notable differences between Tables 8 and 9 with respect to the indicators of political fragility. Whereas the variable War is highly significant and negatively correlated with capital accumulation in Table 8, the result in Table 9 is negative and weakly significant. This is the result of the definition of the war variable which combines cases of war and cases of armed conflict. As shown in Table 8, the latter variable taken individually does not seem to significantly affect the rate of capital accumulation. This confirms the point made earlier that armed conflict does not seem to lead to disruptions and destructions of the magnitude observed with civil wars.

The inclusion of Public investment to GDP in column 2 of Table 9 generates some key results: post-conflict and ODA to GNI variables become negative and significant. This could be due to two reasons. First, the changes could be due to a selection bias given that the inclusion of the public investment variable reduces the sample size by 26 per cent. However, a close inspection of the variable shows that the reduction in sample size is due to data coverage which is shorter for all countries in the sample. Data coverage starts from the 1980s and even 1990s for most countries and ends in 2011 at most. Only a handful of countries, namely Libya, Nigeria, Sao Tome and Principe, and Seychelles do not have or hardly have data on this variable. Hence, that the changes in column 2 of Table 9 are due to a selection bias is possible but unlikely. Second, a more plausible explanation could be the effect of an omitted variable bias. Introducing an omitted variable that proves to be highly significant could have the effect of changing the signs and significance of the other variables in the original regression (Column 1).¹⁵

The coefficient of the post-conflict variable suggests that relative to peaceful periods, countries in post-conflict states destroy their stock of capital at a rate of about 1 percentage point each year. This is less than half of the rate of capital destruction in war periods, as noted above. The fact that the post-conflict variable captures a period which is associated with some level of instability may help to explain this result. Indeed, it has been empirically found that when post-conflict periods are not fully peaceful, countries do not benefit from the peace dividend usually associated with transitions from war to peace (Hoeffler et al., 2010). This finding also supports the “war ruin hypothesis” (Kang and Meernik, 2005) discussed earlier. Countries in post-conflict states face political and economic challenges relating to political stabilization and economic recovery that may take a long time to address. With respect to the negative sign of the aid variable, the implication is that aid should not be considered as a reliable source of capital particularly in post conflict settings. On the contrary, in light of the aid dependence hypothesis, relying on aid could hamper the process of capital accumulation.

5. Conclusion and policy implications

This framework paper analyzes the interaction between political fragility and capital accumulation in Africa. It offers an analytical framework that classifies country-years into three political states, each representing a different form of political fragility. This disaggregation helps to understand specificities that differentiate situations of fragility across countries and time.

¹⁵ Statistically, it is not possible to determine, a priori, the sign of the bias in cases of omitted variable bias.

This framework paper could help in the selection of case studies in such a way that they represent a diversity of political states. The analysis of growth and fragility would benefit from encompassing cases representing all the three cases discussed in this paper.

The main result of the analysis is that countries' experiences vary with the political states that they are in. Periods of war are generally associated with negative rates of capital accumulation. In many countries, this pattern continues even after the war has ended, albeit at reduced rates, lending some credit to the "war ruin hypothesis." Indeed, the end of a violent political confrontation does not necessarily bring an end to a country's political and economic challenges. In many cases, as the examples of Mozambique and Angola mentioned earlier illustrate, it takes decades to steer a country out of the most damaging legacies of a war. Therefore, more attention should be devoted to countries in post-conflict states as they may face specific challenges that are different from those they faced during the conflict.

Moreover, even though high political instability seems to be systematically associated with slow capital accumulation, the analysis of the correlates of capital accumulation suggests that other factors contribute to explaining the pattern of capital accumulation. Indeed, several countries in the sample experienced negative or very low rates of capital accumulation despite the fact that they did not go through episodes of severe armed conflict or civil war. This implies that the search for ways of accelerating capital accumulation in Africa should consider a wide menu of policies that go beyond political factors.

Understanding the pattern of capital accumulation is important primarily due to its strong association with economic growth. Hence, by offering an analytical framework of capital accumulation and economic performance, coupled with the provision of comparative empirical results, this paper could help policymakers in fragile states to better appreciate their performance relative to other countries. For example, a post-conflict country posting an average annual rate of economic growth of 3 per cent might consider itself as doing well in a historical perspective if the comparison is with its own performance during the period of political instability. However, noting that there are other countries in post-conflict states that post two or three times this growth rate might prompt leaders to benchmark their performance to the best performers who are more reflective of the "phoenix factor." The contrasting experiences of Burundi and Rwanda discussed early in this paper illustrate this point.

Finally, the analysis in this paper shows that fragility in Africa is not just about political instability. It has an important economic cost that African countries and their international partners should pay more attention to. Development assistance should be tailored to the specific needs of politically fragile countries by, for example, fueling a process of capital accumulation that, in turn, lays the foundations for Africa's sustainable economic growth. More specifically, humanitarian aid in the early stages of a post-conflict period should be combined with and later replaced by more structural aid directed towards capital formation. A lesson from countries suffering from repetitive armed conflicts and civil wars, such as Burundi, is that sustainable peace depends on the extent to which people benefit from a peace dividend in the short, medium and long terms. Investing in economic infrastructure--both soft and hard--that fosters post-conflict economic recovery, long-term growth and development, should arguably be the main focus of peacebuilding.

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