

Costs of Civil War and Fragile States

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Abstract

Civil conflicts are an important concern for development, yet it is only relatively recently that economists have developed a substantive body of research on them and the research that exists is mainly on the determinants of conflict. This paper provides an analysis of the costs of conflict for the countries that are most affected by it, namely low income and fragile countries in Africa. It provides an analysis of the impact of conflict on economic growth, distinguishing different fragile and non fragile states and finding that there are significant differences, with fragile countries most affected. It also considers the potential spillover effects of conflict, that can further impact upon fragile states and investigates the impact of conflict on other development indicators.

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1 Introduction

Civil war has been both prevalent and increasingly persistent during the past sixty years and yet, until relatively recently, had received little attention from economists (Fearon, 2004). Blattman and Miguel (2010) estimates that since 1960, twenty percent of all countries have experienced at least ten years of civil conflict and, given the important role civil conflict plays in shaping nations, it ought to be central to the study of economic development. It has not been and while there has been an impressive growth of literature on the causes and duration of civil conflict (e.g. see Collier and Hoeffler, 2004; Fearon and Laitin, 2003; Elbadawi and Sambanis, 2004; Collier, Hoeffler and Soderbom, 2004), research on the consequences of civil conflict has been surprisingly limited.

Given that civil war tends to break out in the world's poorest regions and the consequences inevitably affect all parts of the economy, understanding the economic impact of civil war and its costs is an important area of research. These costs encompass not only the direct short-term effects on human beings, infrastructure, investment and the economy, but also the long-term indirect effects on public health and education. Some argue that the destructive forces of civil conflict could be as large as the factor that explains the income gap between the poorest and richest nations (Collier et al, 2003). Collier (1999) estimated that during a war, the growth rate of a country is typically reduced by 2.2% per year. These losses can continue post-war, with Cerra and Sexena (2008) finding output to decline by about 6% after a civil war.

While the general consensus has been that civil conflict is detrimental to economic development, this impact could be even greater for what has been termed fragile states (Rodrik, 1999). While commonly used, the concept of fragility, which is meant to reflect countries that are weak and failing does not have an agreed definition nor is there a definitive list of fragile countries. This paper uses the analysis of the OECD on the dimensions of fragility (i.e. violence, institutions and economic foundations) combined with two lists of

fragile states, by the World Bank (WB) and the Fund for Peace, to get a comprehensive set of fragile countries.¹

So far there has been no substantive attempt to see if fragile states are in fact more greatly affected by conflict than others, so this paper provides such an analysis. It compares fragile states and non fragile states in Africa, using an exogenous growth model, before moving on undertake the analysis using other available indicators of development including education, investment and public health.

The next section considers fragile states and their links to conflict, followed by a review of the cost of conflicts literature in section three. Section 4 then presents the data used and provides some empirical analysis, including estimating a growth model, considering the importance of spillovers and considering the impact on other indicators of development. Finally, section 5 provides some conclusions.

2 Fragile States

It is estimated that over one billion people live in fragile states and these countries are seen to lag behind in meeting the United Nation's Millennium Development Goals (MDGs) (Zoellick, 2008). There is an extremely high prevalence of disease such as HIV/AIDs in these countries, mostly attributed to poor healthcare, a third of the population lack access to clean water, and almost half of the children do not complete secondary education. According to the World Bank's Global Monitoring Report, half of the world's children who do not live to the age of 5 are born in fragile states, while the poverty rate in fragile states averages 54% compared to 22% in other low-income countries. These countries are mostly found in Africa, Asia and Latin America, with the worst situations observed in Africa.

As seen in Africa and particularly with the Democratic Republic of Congo

¹See Appendix Table 1 for full list of fragile countries in Africa.

(DRC), fragile states can quickly create fragile regions. With an ineffective government and an inability to control its borders, conflicts can often arise in the region and spread to neighbouring countries (Francois and Sud, 2006). With a country already suffering from high rates of poverty, malnutrition, hunger, poor healthcare and lack of effective governance, a civil war can be devastating.

While fragility is a major concern, researchers and institutions differ in how they define fragility. The characteristics that stand out are issues with government, income and conflict, so social, economic, political and military indicators can be used (OECD, 2015). There are differences in what are considered the most important factor, with some viewing conflict in this way, while others argue for low income or poor governance (Collier, 2009). A fragile state does not necessarily mean low growth or a lack of efficient government, but rather a failure in the normal process of growth or in the process of setting up a democratic and accountable government. In these cases, there would be scenarios where poverty, inequality, corruption, poor governance form a continuous downward spiral leading to a complete failure of the state (Zoellick, 2008). For this reason a certain amount of judgement is necessary in allocating countries to a fragile category.

Certainly states with the other characteristics of failed states run a higher risk of civil conflict onset than other developing countries and research suggests that it would not be one specific aspect such as poverty or poor governance that leads to conflict, but rather a combination of factors (Dunne and Tian, 2016). Countries that suffer from such problems and have natural resource wealth have a relatively high probability of civil war onset, since it gives an added incentive and opportunity to fight. A cycle of failed government, poverty and conflict, where failed states can be caught in a “conflict trap” as violent fighting weakens institutions, reduces economic growth, destroys infrastructure and redirects resources away from development (Collier and Hoeffler, 2004; Collier, 2007))

By experiencing a conflict and reversing any developmental gains, fragile states are even more vulnerable to collapse and are potentially twice as

likely as other countries to fall back into conflict (Collier, 2007). So, while experiencing conflict can play a part in determining whether a country is considered fragile or not, this judgement will be made at one time point and will not reflect the development of the country over a period of time. Thus it is still of value to examine the impact of conflict on the development of fragile states.

3 Cost of Conflict

While civil conflict is a major concern for developing countries, it is only relatively recently that economists have come to see it as an important area of research. The contribution of economists to an area that had been the preserve of international relations led to a considerable debate over 'greed vs grievance' and a recognition that the causes of conflict are as varied as the nature of conflict and the roots of war are multifaceted, with important historical contexts. There are a number of potential factors that can be identified including colonial legacy; military governments and militaristic cultures; ethnicity and religion; unequal development; inequality and poverty; bad leadership and/or polity frailties and inadequacies; external influences; greed/opportunity/feasibility; and natural resources (Collier and Hoeffler, 2004; Fearon and Laitin, 2003; Ross 2006; Cunningham and Lemke, 2014). Very few conflicts are simple, they are often a combination of factors and this fact can have important implications for the achievement of peace and the success of post conflict reconstruction policies (Dunne, 2013).

Rather less research has focused on evaluating the costs of conflict, despite them being potentially massive. They can be wide ranging, both economic and social and having consequences in the short, medium and long-term (Blattman and Miguel, 2010). In the short and medium term, these include the lives lost, the permanent injuries, the refugees, military expenditure, asset losses (i.e. destroyed capital including human), GDP or production losses (i.e. income), trade losses. Long terms costs, which are less frequently considered

include intergenerational effects, transboundary effects, and environmental effects. Alternatively the costs can be categorized as destruction and deferred accumulation and legacy costs.

Loss of life is the immediately apparent costs of conflict. Most wars are relatively small, with most in the 25-999 battle related deaths per annum. In some datasets these would not be considered, as the definition of an active war is only ones greater than 1000 battle related deaths per annum. But battle-related deaths is not whole story by any means, as in many countries conflict leads to many hidden casualties and the devastation can mean people die for years after a conflict ends - a legacy cost of the conflict that is often ignored. Certainly fatalities for genocides and politicides are disturbing. Up to 1992 Afghanistan had seen over 1 million fatalities, with estimates suggesting almost 1 million military related casualties since the US and coalition invasion. A figure that is dwarfed by the genocide in Cambodia which took an estimated 2.7 million lives (Anderton and Carter, 2009). While the accuracy of these figures can be questioned, as more recent estimates tend to reduce the figures given here (for example in Bosnia) and as they contain relatively imprecise estimates of wider/indirect deaths from war, they still give support to the argument that the immediate and legacy costs of conflict can be very large (Dunne, 2013).

Deaths are only part of the violence engendered by conflict. The World Health Organization (WHO) (2002) differentiates among forms of violence by grouping them into three categories: self-harm (including suicide), interpersonal violence (e.g., violence between intimate partners and other forms of family violence; rape and sexual assault by strangers; violence committed in institutional settings, such as schools, prisons, and workplaces), and collective violence (e.g., armed conflict between, among, and within states; violent political repression and genocide; violent acts of terror; organized crime). Together, these form a system of violence progressing from individual and relationship-related violence to communal and large-scale violence. The existence of conflict in a country creates the environment in which all forms of violence are possible and the less “headline” forms often remain as

a legacy when the conflict is supposedly over (Brauer and Dunne, 2011).

There are two main approaches used in attempting to measure the economic costs of conflict and put a figure on it. First, the economic growth approach, which considers that if conflict affects performance of the economy it should be through the factors of production or technology, plus the institutions and culture that augments them. Different theoretical approaches can give different conclusions. In a basic neoclassical growth model a one time shock to capital stock may not affect the equilibrium, but poverty trap, endogenous growth and vintage type models will give persistent effects that can be damaging (Sachs, 2005). Asymmetric destruction could influence the recovery of an economy and certainly in a Barro type endogenous growth model a disproportionate loss of human capital could lead to slower recovery. There is also an identification problem in that countries in conflict could be different to peaceful countries, so that bad performance after the conflict could reflect what country was like before conflict rather than the fact that it was damaged by the conflict . As regards physical capital, the evidence suggests the post-war evolution of capital shows a rapid recovery to equilibrium, consistent with the neoclassical prediction. Such predictions may be overoptimistic, however, as economic devastation may also prevent a durable peace leading to further costs (Dunne, 2013).

In addition, there are also factors that these models don't consider, the destruction of household assets, the flight of capital, the effect of uncertainty on cost of capital, which can play important roles in economic recovery. As mentioned, lots of people are killed in conflict and this has an impact on the labour force and human capital, but while there may be mixed evidence on how long the economic effects last, there are clearly negative human capital effects on both non-combatants and combatants. While fatalities may be relatively low, as a proportion of population, related deaths and injuries can increase the impact significantly (Ghobarah et al, 2003). At the same time institutions and economic networks also suffer damage and these can be important in hampering growth, though there is little work on how they evolve, adapt and decline in civil war. What effects conflicts have can also

vary by depending on how the war started and why and how it ends, such as in stalemate or victory for one side (Blattman and Miguel, 2010).

Collier (1999) provides a formal framework within which to analyse the likely effects of civil conflict, starting with a Cobb-Douglas production function of the form:

$$Y = AX^\alpha N^{1-\alpha} \tag{1}$$

where Y can be considered as output, N are factor endowments endogenous to civil war and X are those which is exogenous. N in this case can represent numerous variables that output, such as foreign direct investment, education, public health, political and economic institutions. The rate of return on the endogenous factor N will be its marginal product less the rate of depreciation, δ , so that an initial equilibrium is assumed where the rate of return equals r , so that:

$$(1 - \alpha)N^{-\alpha}AX^\alpha = r \tag{2}$$

Civil war will then have an effect on both the supply of endogenous and exogenous factor endowments and so will reduce the rate of return on N relative to that on the foreign asset. This disruption and diversion will reduce factor productivity, lowering the multiplicative constant, A , from A to A_l and so decreasing the rate of return on N . There is also a destructive effect that is equivalent to increasing the rate of depreciation from δ to δ_l . The conflict is also likely to create temporary uncertainty on the rates of return on all forms of factor endowments within the country and, if this persists, the rate of return will be lower than if there was a permanent end to the fighting. This will lead to a premium on the price of the same endowments situated abroad, raising the overall return from r to r_h . By increasing δ and

r and lowering A , the conflict will thus encourage a move of factors out of the the country. The desired stock of endogenous factors will fall and output will fall. This means that GDP is reduced by the disruption and diversion effects, which are immediate and overtime, but also through the decrease in N due to destruction, dis-savings and capital flight. This gives a useful framework within which to motivate and locate the analysis of the cost of conflict using a simple growth model discussed below.

When conflicts occur it is not just a cost to the countries involved, but also to neighbours and other countries in the region. Collier (1999) recognised this and Murdoch and Sandler (2002a) provided an analysis of spillover effects on neighbouring countries, finding for a sample of 84 countries during the period 1960 to 1990, that civil wars had a significant negative influence on the steady-state level of GDP per capita for both the conflict afflicted country and its neighbours. In two subsequent papers, Murdoch and Sandler (2002b, 2004) varied the time periods, country samples and the definition of contiguity, using the Gleditsch and Ward (2001) minimum distance between nations dataset. In all three papers, the long-run effects of conflict were insignificant, which they attribute to Organski and Kugler's (1980) phoenix effect, while civil wars were found to have a negative and significant short-run growth effect on both the host and neighbouring countries.²

This analysis was developed by de Groot (2010). Firstly, he argued that Murdoch and Sandler's theoretical model restricts spillover effects to be uni-directional and thus lacks the flexibility to estimate a "bounce back" effect that exists between contiguous states.³ Distinguishing between primary, contiguous, neighbours and secondary neighbours, those non-contiguous states within a set distance threshold, allowed both uni and multi-dimensional spillover effects to be captured. Secondly, by replacing the dummy variable

²The phoenix effect is named after the metaphor of a phoenix rising from the ashes, symbolising that for a post-conflict society, their GDP per capita may be at such a low base that they are able to rebound quickly and reach their steady-state growth path. Also a representation of conditional convergence.

³This "bounce back" effect describes the ability for the spillover effects to flow back and forth from the host country and its neighbours.

for contiguity with the actual minimum distance between countries it gave a more satisfactory continuous measure of spillover. Using data for Africa from the period 1960 to 2000, the distinction between primary and secondary neighbours led to very different conclusions. Rather than a general negative growth effect from conflict on all neighbours, de Groot (2010) suggested that there could be a growth trade-off that benefits secondary neighbours but punishes primary neighbours. In addition, while previous work focused on civil wars, de Groot considered all forms of conflict and found the results to be consistent. Dunne and Tian (2016) developed this work to allow for the issue of whether physical distance measures are adequate in assessing spillover effects, following Beck et al (2006) and Suleyan and Gleditsch (2006) suggestions that more than political, economic and even cultural 'distance' needed to be taken into account.

A second approach attempts to measure the actual cost of conflict and has taken two forms, the accounting and the counterfactual method. In the accounting method, the researcher tries to work out the total value of goods, assets etc destroyed in the conflict. A fairly comprehensive schema would set the direct and indirect costs and find values for as many of the headers as possible. This is a very difficult task and can really only be attempted for case studies of individual countries and in most cases there will be many missing values and 'guesstimates'. Some recent effort has been made in this, but it is difficult to compare and aggregate to get a figure for total costs. Different countries are likely to have different headers completed and different levels of detail available (de Groot et al, 2009). The problem with this sort of method is the more carefully you look the more cost you can find and so high costs might simply reflect high effort by the researchers rather than any real difference in cost of conflict

The more commonly used counterfactual method, makes an effort to compare the path the economy in and after the conflict with the likely path it would have taken in the absence of conflict. This comparator could be a simple trend, the average for the income bracket of the country, another similar country, or an artificial country (a combination of countries that reflect the

characteristics of the one under study. The area in between the lines then indicates cumulative GDP losses (Brauer and Dunne, 2012). This is clearly a stylised perspective and there is some debate over what happens during the crisis and how to measure the counterfactual, but it is a useful heuristic device.

In 2008 the United Nations Development Programme (UNDP) Bureau for Crisis Prevention and Recovery suggested that the economic cost of civil war lies somewhere between 1.7 and 3.3 percent of GDP per country per conflict year before 1990 and the average reduction was about 12.3 percent of GDP after 1990, the post–Cold War era (UNDP, 2008). The apparent loss of output is staggering and while countries do recover it is not for a good number of years.

So measuring the costs is not straightforward. There are different methods, which measure different things and can give rather different answers. Economists do not agree on how to fully enumerate, let alone compute, the global cost of war, let alone the cost of all violence, war-related or not. What is required are comprehensive and consistent computations of current cost, legacy cost, and spill over cost. The current cost is the direct and indirect cost of violence, the legacy cost includes the cost of past violence that carries into the present (e.g., reduced productivity on account of permanent injury; continuous health care for the injured) and the spill over costs relate to the impact on others (e.g., refugees) (Bozzoli et al, 2008, 2010).

Although the linkage between armed conflict, violence and development is not explicit in the Millennium Development Goals, objectives such as reducing poverty, ensuring maternal health and promoting education are all associated with effective armed violence prevention and reduction initiatives. The World Bank’s World Development Report 2011 points out that not a single fragile state afflicted by violence has achieved even one of the eight goals. An example is Ethiopia which showed a steady rise in GDP from 1950 to 1974, with per capita GDP \$279 in purchasing power parity dollars in 1950 and \$473 in 1974, an increase of about 70 percent over 25 years, or 2.8 percent per person per year. Then things changed, 1974 saw a vio-

lent revolution and 1977 a war with Somalia. The early 1980s saw several massive famines and a brutally repressive political regime, while the early to mid-1990s saw violently contested elections and long-running secessionist movements in Tigray and Eritrea resulted in more violence. Eritrea gained independence in 1993, but a border war with Ethiopia broke out in 1998 that was only nominally settled in 2000. Over the thirty-year period from 1975 to 2004, economic output per person was flat. Had Ethiopia continued to grow at its 1950–74 rate average production should have reached about \$800 in 2009 instead of the \$684 actually achieved, and it reached this level only due to a growth spurt of the last five years of the data series. The size of the cumulative loss of production was \$7,721, over eleven years' worth of 2009 income (Brauer and Dunne, 2012).

Not all researchers see a negative impact for conflict. Some suggest a positive role of modernisation where conflict and war can have positive effects on a country. While there is little discussion of the possible benefits of conflict and armed violence, they do exist and can be important. Many modern states owe their form to some conflict or other and conflict and war can have positive economic effects in removing bad leaders or leading to the introduction of structures and governance needed for modernisation. In an attempt to rebalance the analysis of civil wars, Cramer (2006) points out that conflicts could be important in the process of economic development, allowing the “primitive accumulation” that allows resources to be placed in the hands of a ruling class that can use them to support industrialisation. In addition, the basic neoclassical models would forecast that countries will just bounce back quickly from conflict to long term trend, with some sort of phoenix effect (Organski and Kugler, 1977). But such predictions would be for the long run and it is unclear how long that could take. Certainly the destruction of old capital can have benefits and there may even be human capital benefits, while there may be positive effects of spillovers, as immigrants/refugees can boost the labour force in the host country. While there may be such benefit, it is extremely difficult to measure them, or to disentangle them from the negative impacts we consider next. It is, however, important to recognize

that conflicts can be complex and have complex effects and that care needs to be taken in any form of intervention.

4 Data and Empirical Analysis

The primary independent variable of concern, civil conflict experience and battle related deaths, is taken from the UCDP/PRIO armed conflict database and a civil war experience variable constructed as a dummy variable taking a value of 1 if there is over 25 battle-related deaths in a given year and 0 otherwise. GDP, population and capital stock or investment were taken from the World Bank's African Development Indicators (ADI's). Measures for institutional quality, state capacity or political freedom follow the commonly accepted proxy variables from the Polity IV and Freedom House data sets. Using the Polity IV database to measure political rights or institutional capacity, the variable *polity* is on a 21-point scale ranging from -10 (high autocracy) to 10 (high democracy). Data for GDP, investment, civil war, institutional quality, population and education can be found for numerous years and panel datasets constructed period 1960 to 2010. This give 36 African countries over 51 years, of which 18 are fragile and 18 are non-fragile.

In defining a fragility, this paper uses the combined definition of fragility by the OECD and Fund for Peace. Fragility is determined based on a comprehensive set of characteristics such as social, political, economic and military factors. Countries are determined on a country by country basis and countries do not necessarily have to perform poorly in all indicators in order to be classified as fragile or vice versa. For example, in the case of Togo, although it has not experience any form of civil unrest between 1960 and 2010, its poor economic and social factors means it is classified as a fragile state. The same can be said for the alternative, although Mozambique experienced prolonged civil fighting, had a low level of per capita GDP and poor political freedom, in the past two decades it has performed very well in all fragility factors (more than doubling its per capita GDP, improved on political freedom and

has absent of civil conflict) and thus has been classified as non-fragile.

Table 1 presents the means and standard deviations of this data for both fragile and non fragile states. It also reports data that is not available as consistent time series. To measure the level of education, the adult mean years of schooling is taken from UNESCO Institute of Statistics. Levels of public health, another indication of potential human capital is measured through the World Health Organisations (WHO's) disability-adjusted life years(DALYs). This variable records the number of life years lost through over 160 forms of disease and disability.Finally, rate of urbanisations, a proxy for development is extracted from the World Bank world development indicators. Other variable can only be collected in cross sectional datasets, giving limited coverage over time, but greater coverage of countries. Some variables, such healthcare, are only available for certain years (e.g. 2000 and 2012). Thus the first part of the Table considers the panel data and the second part a cross section of selected variables for 2012.

Table 1: Descriptive Statistics - Means

	Fragile		Non-Fragile	
	Mean	Std Dev	Mean	Std Dev
<i>Panel Data - 1960-2010</i>				
GDP per capita	630.3	359.5	1989.7	2148.9
Civil War Prevalence (%)	17.64	38.14	8.74	28.26
Investment % GDP	15.70	12.63	20.94	14.60
Population (000's)	13375	20961	9754	13502
Polity IV (-10 to 10)	-3.49	5.10	-1.56	6.46
<i>Cross-Sectional Data - 2012</i>				
Healthcare Exp (% GDP)	6.21	2.43	6.76	2.64
CW Deaths in 2000's	7334	21227	1308	4922
DALY (000's)	19064	31954	15781	56112
Education (Years of school)	3.99	1.62	8.54	2.86
Rate of Urbanisation (%)	1.22	0.93	0.61	0.89
Polity IV (-10 to 10)	1.58	4.67	4.42	6.45

Table 1 shows clear differences between the characteristics of fragile and non-fragile states. For the panel data's 36 countries, the mean per capita GDP for fragile states is \$630, while for non-fragile states it is three times higher at almost \$2000. Civil war also seems much more likely in a fragile state, with its prevalence at 17.6% versus non-fragile states 8.7%. Investment as a share of GDP for non-fragile states is on average 5 percentage points higher than fragile states. A similar pattern can be seen in the cross-section data, in the second section of the Table, where political freedoms, mean years of adult schooling (proxy for education and human capital), average healthcare expenditure as a share of GDP are all better in a non-fragile state. Between 2000 and 2008 fragile states saw almost six times more battle deaths than non-fragile states, reflecting the higher prevalence of civil wars in those countries, but also more deadly wars. Such an environment is likely to result in the deterioration of the healthcare system and the mean of the disability adjusted life years (DALYs) and so the observed higher life years lost in fragile countries than non-fragile countries. Interestingly, the difference in DALYS is of a much smaller order of magnitude than that for conflict related deaths.

In Table 2 the correlations between conflict and the panel data variables also shows quite marked differences between fragile and non fragile states. These are correlations of the pooled data, so the lack of significance is not surprising, but the relatively larger and negative correlations between conflict and income and investment that does not follow through to the non fragile states is interesting. There are 1275 observations for the non fragile countries, of which 172 are also conflict influenced and 1224 for the fragile countries, of which 292 were conflict influenced.

Table 2: Correlations

	(1)	(2)	(3)	(4)
Country Type	All	Fragile	Non-Fragile	
Conflict				
$\ln(y)$	-0.082	-0.121	0.030	
$\ln(inv)$	-0.060	-0.122	0.072	
$\ln(edu)$	0.028	0.123	-0.020	
$\ln(pop)$	0.304	0.290	0.333	
Polityiv	0.000	0.155	-0.097	
Conflict	-0.099			
Country Type	All	Conflict	Non-Conflict	
Fragile				
$\ln(y)$	-0.502	-0.590	-0.048	
$\ln(inv)$	-0.199	-0.383	-0.157	
$\ln(edu)$	-0.307	-0.194	-0.330	
$\ln(pop)$	0.080	-0.308	0.102	
Polityiv	-0.217	0.065	-0.260	
Fragile	-0.099			

4.1 Conflict and Growth

To consider the impact of conflict on growth an extended version of the neoclassical growth model, a human capital augmented production function featuring a Harrod-neutral technical progress is used:

$$Y(t) = K(t)^\alpha H(t)^\beta [A(t)L(t)]^{1-\alpha-\beta}, 0 < \alpha + \beta < 1 \quad (3)$$

where α and β are the elasticities of output with respect to physical and human capital respectively. $Y(t)$ denotes output at time t , $K(t)$ is physical capital, $H(t)$ is stock of human capital and $A(t)$ is the technology parameter with output elasticity of $(1 - \alpha - \beta)$. Labour is assumed to grow at an

exogenous growth rate of n , technical progress will grow at the exogenous rate of g and both physical and human capital will depreciate at the identical rate δ .

Following (Dunne et al, 2013) a dynamic specification of the estimated model is:

$$\Delta \ln y_{i,t} = \gamma \ln y_{i,t-1} + \sum_{j=1}^3 \beta_j \Delta \ln x_{j,i,t} + \sum_{k=1}^2 \alpha_k \ln x_{k,i,t-1} + \eta_t + \mu_i + \nu_{i,t}$$

$$; i = 1, 2, \dots, N; t = 1, 2, \dots, T \quad (4)$$

where y is GDP per capita, x_1 is gross fixed capital formation as a share of GDP (proxy for investment or capital stock), x_2 is military spending as a share of GDP, x_3 is the population growth rate plus 0.05 or $(n + g + d)$. The re-parameterised general first-order dynamic model is then estimated and the results are presented in Table 2, where all variables are in logs (l), Δ represents the change in the variable, $(t - 1)$ denotes a lag of one period, the dependent variable in all regressions is $\Delta l y$ and representing the change in per capita GDP.

The specification can be augmented by a social, political and economic variables, seen as acting through the technology term in the growth model, or simply as conditioning variables. These variables include episodes of civil conflict, military spending, labour supply (i.e. population growth), human and physical capital, investment, healthcare, political freedom, institutions, education and trade.

As outlined above, civil war leads to destruction of resources, the most obvious way is through killing or maiming of the labour force and destruction of goods, capital and infrastructure, but it will also disrupt social order, suppressing civil liberties (political and social freedom) and so reducing the efficiency of public expenditure (Isham et al., 1996). As Collier (1999) argues, it will also lead to a premium on the return to assets held abroad and lead to capital flight and discourage local investment. Such effects will damage

the rate at which human and physical capital is accumulated; limit investor confidence and hence divert investment and trade away from the country and through spillover effects, the region.

Table 3 provides estimation results for the benchmark growth model before other development variables are considered. In column 1, the results without the conflict dummy show investment and initial income to be of the expected sign and statistically significant, but human capital is negative and significant, while population growth plus 0.05, which theoretically should have a negative impact on per capita GDP growth, is positive and statistically significant. This result for population growth is not unusual within the literature, particularly for low-income developing regions, such as Africa or Asia and it certainly does not seem unreasonable in post conflict economies (Grier and Tullock, 1989).

Similarly, the negative result for human capital is not uncommon within the literature and Islam (1995) attributes it to the discrepancy between the theoretical variable H (measuring quality) used in the model to the actual variable (measuring quantity) used in regressions. Likewise, the education variable in Murdoch and Sandler's papers and de Groot (2010) vary in sign and significance. In the case of Africa and many other low-income countries, the true levels of human capital may not have increased much since 1960 and statistically this leads to a negative temporal relationship between human capital and economic growth. Moreover, it is often the case that education attainment does not translate into increased productivity and in many African countries the quality of education is a major concern.

Table 3: Growth, Conflict and Fragility 1960-2010

	(1)	(2)	(3)	(4)
Country Type	All	All	Fragile	Non-Fragile
Variables	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$
$\Delta \ln(inv)$	0.036** (0.006)	0.036** (0.006)	0.021* (0.009)	0.064** (0.008)
$\Delta \ln(edu)$	-0.079* (0.031)	-0.075* (0.031)	-0.163** (0.057)	-0.005 (0.034)
$\ln(n + g + \delta)$	0.021** (0.005)	0.021** (0.005)	0.041** (0.007)	0.009 (0.006)
$\ln(y_0)$	-0.028** (0.005)	-0.029** (0.005)	-0.048** (0.009)	-0.022** (0.006)
$\ln(inv_{t-1})$	0.020** (0.003)	0.020** (0.003)	0.029** (0.005)	0.011** (0.004)
$\ln(edu_{t-1})$	-0.023** (0.004)	-0.019** (0.004)	-0.021** (0.008)	-0.015** (0.005)
Conflict		-0.017** (0.005)	-0.020** (0.007)	-0.014* (0.006)
Year	0.001** (0.000)	0.001** (0.000)	0.001 (0.001)	0.001** (0.000)
Constant	-1.941** (0.540)	-1.597** (0.540)	-1.160 (1.051)	-1.500** (0.571)
Observation	1765	1765	872	893
R-squared	0.185	0.190	0.209	0.114

Notes: Dependent variable: $\Delta \ln y$; All regressions include time trend variable; Standard errors in parentheses; Significance levels:** $p < 0.01$,* $p < 0.05$,† $p < 0.1$

Armed conflict in the host country has a significant negative influence on economic growth and this is true for all three country specification (Columns 2 to 4). Not surprisingly, given the earlier results and discussion, civil conflict in fragile countries (Column 3) has the largest negative impact on growth, decreasing growth on average by 2.0 percentage points, while conflict in all

and non-fragile country sample decrease growth by 1.7 and 1.4 percentage points respectively.

4.2 Spillover Effects of Conflict

To evaluate the spillover effects, following the existing literature, host country conflict is a dummy variable and primary neighbour contiguity matrices are constructed using two approaches. Firstly, using a dummy variable approach, a value of 1 is given to countries sharing a border with the host nation and 0 otherwise. Additionally, a border length approach is used, where border distance between countries is used as a matrix element. For the primary neighbour weights, the dummy variable and border length are divided by the sum of all primary neighbours and the total distance of the host country's border length respectively. In the border length matrix, this means the longer the border length between two countries, the larger the potential spillover effect. For secondary neighbours within a 1000 kilometre radius, the exact geographical distance of the closest route between the host country and all secondary neighbours is used.

Taking the growth model specification in equation (4) and introducing dynamics gives the estimation equation:

$$\begin{aligned} \Delta \ln y_{i,t} = & \alpha \ln y_{i,t-1} + \sum_{j=1}^3 \beta_j \Delta \ln x_{j,i,t} + \sum_{k=1}^2 \beta_k \ln x_{k,i,t-1} + \theta_1(\text{conf}_{i,t}) \\ & + \theta_2 W_{pri}(\text{conf}_{pri,i,t}) + \theta_3 W_{sec}(\text{conf}_{sec,i,t}) + \eta_t + \nu_i + \varepsilon_{i,t} \end{aligned} \quad (5)$$

where y is GDP per capita, x_1 is investment as a share of GDP, x_2 is secondary educational attainment as a share of population over the age of 25 and x_3 is the population growth + 0.05 or $(n + g + \delta)$. All non-dummy variables are in logs, with Δ representing the change in the dependent and explanatory variables. There is also a lagged dependent variable and lagged levels of physical and human capital. W_{pri} and W_{sec} are the contiguity matrices for primary and secondary neighbours, varying in the type of contiguity

matrix (e.g. geographical distance), which are interacted with neighbour conflict indicators to generate the spillover variables. Finally, η_t and ν_i capture time and country fixed effects respectively, while $\varepsilon_{i,t}$ is the error term.⁴

Table 4 reports the coefficient estimates for the conflict and contiguity variables, using geographical distance, which are added to the base model reported in Table 3. These were the best fitting models, in terms of R squared, from a range of regressions run on conflict type and different weighted contiguity matrices, using three different measures of conflict (all types of conflict, intense conflict and civil conflict) and considering both uni-dimensional and multi-dimensional spillover effects.⁵

Uni-dimensional effects are observed when only one set of neighbours is considered, primary or directly contiguous neighbours, while multi-dimensional effects involve both primary and secondary neighbours. Specifications 1, 3 and 5 represent uni-dimensional spillovers, while 2, 4 and 6 are multi-dimensional. In all six specifications, conflict in a host country is estimated to have a negative and significant effect on host nation growth, with the spillover effects of conflict on neighbouring countries' growth rates differing. While a host country conflict – irrespective of type – negatively affects primary neighbour growth, no such influence was found on secondary neighbours.

The results show a host-country conflict to have negative growth effects on primary neighbours of between 1.2 to 2.0 percentage points across the specifications. Interestingly, the coefficients for primary neighbours are only marginally smaller when multi-dimensional spillover effects are added. This may be indicative of a small “bounce back” effect primary neighbours experience from its neighbours (e.g. a host nations secondary neighbour).

⁴The empirical equation contains a lagged dependent variable which can bias the estimates.

⁵The difference between the reported regressions and regressions with a lower R-squared was negligible, with all variables of the same sign and significance. Moreover, the R-squared between the different regressions do not vary by more than 0.02. Of the different contiguity matrices, border lengths for primary neighbours and minimum distance for secondary neighbours provided the best fit.

Interpreting the coefficients for neighbours is slightly different to that of the host nation, as the coefficients are measuring a neighbourhood effect, which takes into account that each country has several neighbours. This means dividing the coefficients of $W_{pri}Conf_{pri}$ by the average number of primary neighbours. A host nation has on average 4.25 primary neighbours, translating to a per country influence of 0.235 ($\frac{1}{4.25}$), which implies that a host country conflict (column 2) will on average reduce a primary neighbour's growth by 0.28 ($0.235 \cdot -0.012 \cdot 100 = -0.28$) percentage points. Depending on the types of conflict, this negative effect varies from 0.45 percentage points for intense conflicts to 0.35 for civil wars. The spillover effect from a conflict to primary neighbours is calculated to be roughly 20% ($(0.28/1.4) \cdot 100$) of the host country effect, with intense and civil wars approximately 20 and 29% of the host country effect, respectively. These results are in line with Murdoch and Sandler's but differ from de Groot (2010) in finding no positive spillover effect on secondary neighbours.

Table 4: Spillover Effects of Conflict with Geographical Contiguity Matrices

	(1)	(2)	(3)	(4)	(5)	(6)
Conflict:	Conflict		Intense		Civil	
Weight:						
Pri	Border	Border	Border	Border	Border	Border
Sec		Dist		Dist		Dist
Variables	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$
Conflict	-0.015** (0.005)	-0.014** (0.005)	-0.023** (0.007)	-0.023** (0.007)	-0.012* (0.005)	-0.012* (0.005)
$W_{pri}Conf_{pri}$	-0.013* (0.007)	-0.012 [†] (0.007)	-0.020** (0.009)	-0.019* (0.009)	-0.016* (0.007)	-0.015* (0.007)
$W_{sec}Conf_{sec}$		-0.008 (0.009)		-0.010 (0.013)		-0.017 [†] (0.010)
Constant	-1.882** (0.538)	-1.874** (0.538)	-1.827** (0.540)	-1.789** (0.542)	-1.951** (0.539)	-1.994** (0.539)
Observations	1765	1765	1765	1765	1765	1765
R-Squared	0.104	0.104	0.104	0.104	0.102	0.104

Notes: Dependent variable: $\Delta \ln y$; All regressions include time trend variable; Clustered standard errors in parentheses; Significance levels: ** $p < 0.01$, * $p < 0.05$, [†] $p < 0.1$

To test if spillover effects from a civil war is different between fragile and non-fragile states, the spillover regression containing geographic distance is divided into fragile and non-fragile states. The results are shown in Table 5, with specifications 1 and 2 providing estimation results for fragile countries and specification 2 and 4 for non-fragile states (Different specifications control for uni and multi-dimensional spillover effects).

The results for conflict affected countries are identical to those in Table 3 and 4, with coefficients ranging between 1.2 and 1.9 percentage points across the specifications. Again, there seems to be no significant spillover effect of

conflict on secondary neighbours irrespective of a country’s fragility. There is, however, a substantial difference in the spillover effect of conflict on primary neighbours based on fragility.

Table 5: Spillover Effects of Civil Conflict with Geographic Contiguity Matrices and Controlling for Fragility

	(1)	(2)	(3)	(4)
Country:	Fragile		Non-Fragile	
Weight:	Civil Conflict		Civil Conflict	
Pri	Border	Border	Border	Border
Sec		Dist		Dist
Variables	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$
Conflict	-0.019** (0.007)	0.019** (0.010)	-0.012* (0.006)	-0.013* (0.006)
$W_{pri}Conf_{pri}$	-0.022* (0.010)	-0.019* (0.009)	-0.014† (0.008)	-0.013 (0.008)
$W_{sec}Conf_{sec}$		-0.030† (0.016)		-0.012 (0.009)
Constant	-2.036* (0.855)	-2.101* (0.852)	-1.251* (0.560)	-1.237* (0.560)
Observations	872	872	893	893
R-Squared	0.142	0.146	0.131	0.132

Notes: Dependent variable: $\Delta \ln y$; All regressions include time trend variable; Clustered standard errors in parentheses; Significance levels:** p<0.01,* p<0.05,† p<0.1

Firstly the estimated negative coefficients of a primary neighbour civil conflict are between 46 and 60 percent larger in the case of fragile states versus non-fragile states. Additionally, the spillover impact from a civil conflict in fragile states is significant at the 5 percent level for fragile states (uni and multi-dimensional effect). On the other hand, for non-fragile states, the negative repercussion of civil conflict is only marginally significant (10

percent level) using uni-dimensional spillover effects and not significant at all when multi-dimensional effects are added. This is an interesting result, suggesting not only that a host country civil conflict is worse for fragile states than non-fragile states, but also fragile states are more negatively impacted from a neighbouring conflict than non-fragile countries.

The trend in fragile states being affected more than non-fragile state continues when we consider only intense civil wars that have more than 1000 battle related deaths. As shown in Table 6, there remains a vast difference in the spillover impact a civil war has on neighbouring countries. Depending on whether a country is classified as fragile, a civil war in a neighbouring country not only has a negative and significant impact on host country economic growth, but the coefficient (in both uni and multi-dimensional spillover regressions) is about three larger than a non-fragile country. An intense civil war in a neighbour country will decrease economic growth of a fragile state by on average 0.89 percentage points ($-0.033/3.7*100=0.089$) for uni-dimensional spillover effects and 0.76 percentage points when multi-dimensional spillover effects are added.

In terms of considering national accounts data and per capita economic growth, the growth regressions provided in Table 3 to 6 greatly suggest a vast difference in the impact civil war has on different types of country states. While a civil conflict or intense war in a host country is estimated to always have a negative impact on said country's economic performance, the size of the adverse effect is almost always large for a fragile state compared to a non-fragile state. When spillover effects are considered, the story is very much the same. Civil war in a neighbouring country is estimated to have a significant and detrimental consequence on fragile country development, while no such impact was seen in non-fragile states. While non-fragile countries are already better off than in terms of economic, social and political aspects, it seems that they are also on average more robust at withstanding the harmful consequences of a neighbouring civil conflict than an equivalent fragile country.

Table 6: Spillover Effects of Intense Civil Conflict with Geographic Contiguity Matrices and Controlling for Fragility

	(1)	(2)	(3)	(4)
Country:	Fragile		Non-Fragile	
Weight:	Intense Civil War		Intense Civil War	
Pri	Border	Border	Border	Border
Sec		Dist		Dist
Variables	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$	$\Delta \ln y$
Conflict	-0.024** (0.011)	0.019** (0.007)	-0.020** (0.007)	-0.020** (0.006)
$W_{pri}Conf_{pri}$	-0.033* (0.013)	-0.028* (0.014)	-0.009 (0.012)	-0.010 (0.012)
$W_{sec}Conf_{sec}$		-0.027 (0.024)		-0.006 (0.013)
Constant	-2.031† (1.04)	-1.965† (1.04)	-1.185* (0.550)	-1.209* (0.553)
Observations	872	872	893	893
R-Squared	0.258	0.259	0.135	0.136

Notes: Dependent variable: $\Delta \ln y$; All regressions include time trend variable; Clustered standard errors in parentheses; Significance levels: ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

4.3 Other indicators

In addition to its impact upon growth one might expect conflict to affect investment in fixed and human capital and healthcare. To consider the possible impact upon capital investment a simple multiplier accelerator model, conditioned on polity and conflict was estimated using fixed effects and gave the results in Table 6. There is clearly no significant impact of conflict for both fragile and non fragile countries and the results remain consistent when

the Polity IV variable is removed and a trend is included.

Table 7: Effects of Conflict on Investment

Country Type Dep Var	(1)	(2)	(3)	(4) (5)
	All	Fragile	Non-Fragile	
$\Delta \ln(y)$	0.362 (5.43)	0.510 (4.60)	0.267 (3.29)	
$\ln(y_{t-1})$	0.016 (0.97)	0.061 (1.88)	-0.002 (-0.14)	
$\ln(\lnv_{t-1})$	-0.128 (11.92)	-0.135 (-8.87)	-0.123 (-8.12)	
<i>PolityIV</i>	0.003 (2.57)	0.004 (2.17)	0.003 1.96	
Conflict	0.010 (0.56)	0.011 (0.49)	0.012 (0.45)	
Constant	-0.345 (-2.94)	-0.658 (-3.04)	-0.190 (-1.32)	
Observation	2240	1187	1053	
R-squared bet	0.457	0.400	0.502	

Notes: Dependent variable: $\Delta \ln inv$; t values are in parentheses;

To consider the impact of conflict human capital, as measured by education (years of schooling) a simple demand for education equation was estimated and the results in Table 7 show conflict to be positive but insignificant at the 5 percent level of significance. It is significant at 10 per cent, for fragile states only.

Table 8: Effects of Conflict on Education

Country Type Dep Var	(1)	(2)	(3)	(4) (5) (6)
	All	Fragile	Non-Fragile	
$\Delta \ln(y)$	-0.023 (-1.32)	-0.034 (-1.85)	0.004 (0.13)	
$\ln(y_{t-1})$	0.022 (6.15)	0.009 (1.86)	0.057 (8.98)	
$\ln(edu_{t-1})$	-0.022 (-15.30)	-0.017 (-10.56)	-0.039 (-13.40)	
<i>PolityIV</i>	-0.001 (-4.85)	-0.002 (-4.83)	-0.001 (-2.56)	
Conflict	0.006 (1.81)	0.007 (1.70)	0.005 (0.80)	
Constant	-0.057 (-2.44)	0.017 (0.55)	-0.269 (-6.48)	
Observation	1740	886	854	
R-squared bet	0.000	0.008	0.034	

Notes: Dependent variable: $\Delta \ln inv$; t values are in parentheses;

These results, though preliminary, do not suggest any discernible impact of conflict on capital investment in either fragile or non fragile countries, but does give some evidence of a positive effect on education (at 10 per cent significance) in fragile states. This is a strange enough result to warrant further investigation.

5 Conclusions

Conflict and particularly civil wars have been found to have large costs for the countries affected and their neighbours. It also disproportionately impacts upon the very poorest countries (Collier, 1999; Dunne, 2013). Despite

these findings, there is relatively little empirical research on the effects of conflict and it is seldom given adequate attention in development economics textbooks. It is also of particular concern for fragile states as the impact of a civil conflict, or the re-ignition of a previous one can potentially be devastating.

This paper has provided an empirical analysis of the impact of conflict on developing economies in Africa and compared the effects on fragile and non-fragile economies. Having identified the fragile economies and illustrated the high degrees of disadvantage they have relative to non-fragile countries in Africa, an exogenous growth model was estimated and found to be well specified for both sets of countries and to show a significant negative impact of conflict, particularly for fragile economies, where conflict reduces growth on average by two percentage points per year.

A further concern is the impact of conflict on neighbours, through spillover effects, which have been found to be larger than the effects of the war-torn country (Collier, 1999; Dunne, 2013). An extension to the basic growth model was developed to allow for the effects of conflicts on neighbours, following Murdoch and Sandler (2002a, b; 2004) and de Groot (2010). Using distance weights and these were found to be significant and large, particularly for close fragile neighbours, giving a negative effect of conflict on the host economy and negative effects of spillovers on neighbours.

Overall, these are important results as they make clear the cost of conflict for fragile states and the degree to which conflict can hinder economic development. It also makes clear that they can suffer badly from conflicts within their neighbours even when they are not directly involved. Showing the importance of spillover and the need to consider more than just geographical measures of closeness, strengthens the argument of Murdoch and Sandler (2004) that aid is potentially necessary in conflict regions, rather than just the directly affected countries.

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Appendix

Table 9: List of Countries in Panel Dataset

Fragile	Non-Fragile
Burundi	Algeria
Central Africa Republic	Benin
Congo D.R.	Botswana
Congo Republic	Cameroon
Kenya	Cote D'Ivoire
Lesotho	Egypt
Liberia	Gabon
Malawi	Gambia
Mali	Ghana
Mauritania	Mauritius
Niger	Morocco
Rwanda	Mozambique
Sierra Leone	Namibia
Sudan	Senegal
Swaziland	South Africa
Togo	Tanzania
Uganda	Tunisia
Zimbabwe	Zambia