

Can Aid Break the Conflict Trap?*

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Abstract

This paper investigates the effect of Overseas Development Assistance on the duration of peace after a civil war. Indeed, some countries appear to be stuck in a so-called ‘conflict trap’, underlying the need to assess whether aid helps making peace sustainable or, on the contrary, whether it leads to an increase in the risk of a new war outbreak. Using a survival analysis model, results tend to confirm that aid stabilizes post conflict environments, however with a U-inverse shaped effect. The optimum ratio of aid to make peace last is defined at 4.83% of GDP of the recipient country, notably higher than the 2.27% average observed in our sample. The presence of a UN peacekeeping mission tends also to have a positive effect on the duration of peace and seems to raise the capacity of absorption of aid.

Key words: civil war, aid efficiency, post-conflict

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1 Introduction

During the second half of the 20th century civil war constituted one of the principal hindrances to development. If the trend in the number of on-going wars seems to follow a decreasing path since about ten years ago, civil wars are still breaking out on almost all continents. According to the World Bank, violence in the 1990s led to around 13 million refugees and 38 million displaced persons around the world. Moreover the percentage of civilians killed during conflict has been drastically increasing (90% of casualties as opposed to 50% in the 18th century). In response to the disaster that constitutes civil war, the international community has not always fulfilled expectations. Nowadays, the concerns of the community seem to have evolved as the March 2005 declaration of former UN General Secretary Kofi Annan illustrates: ‘*No task is more fundamental to the United Nations than the prevention and the resolution of deadly conflict*’¹.

The burden of the war often adds up to the resumption of hostilities and some countries seem to be stuck in a war spiral. This observation is at the root of this study. Hence, the aim of the econometric analysis is to determine whether or not international aid represents an appropriate tool to make peace sustainable once achieved. This important question can only be assessed since only quite recently, as the data is now sufficient to enable the use of such an empirical method.

Part 2 underlines the costs of the civil war and justifying the world concern. Parts 3 and 4 explain the specificities of the post conflict environment and describe what interventions could be considered on the basis of the existing literature. Part 5 describes the dataset and Part 6 the empirical model and the regressions. Part 7 consists of the interpretation of the results obtained through the econometric analysis and finally Part 8 concludes.

2 The huge costs of civil war: peace as a world public good

The consequences of civil war are enormous, as increasingly shown by the media. But what images and testimonies report represents only the tip of the iceberg of the war burden. In particular, the consequences for nations lying at the bottom of the charts of developing countries are titanic. If the country itself is experiencing what could be called a ‘backward development’ or ‘development in reverse’, the damages do not stop at the border and the entire region is often affected.

2.1 At the national level: backwards development

As stated by Collier & Hoeffler, ‘*When translated into economic terms, the glorifying language of armed struggle implies that rebellion is usually a socially productive investment. [...] On average, modern*

¹Kofi Annan, ‘In larger Freedom: Towards Development, Security and Human Rights for All’, March 2005.

*civil war has been a development in reverse*².

Unsurprisingly civil war is estimated to reduce growth during the period of conflict (Collier, Hoeffler & Söderbom, 2001). The most evident cause is the destruction of infrastructure and capital, physical and human. Inputs then disappear and production is strongly affected. Collier (1999) identifies four additional reasons why war decreases growth: public resources tend to be redirected from productive activities to violence (army, armament, etc.); opportunist behaviour increases as time horizon shortens; physical and human capital is flown abroad translating into massive financial and migration outflows; war leads to a substantial drop in the intensity of activity in vulnerable sectors, often the most productive, to the profit of less vulnerable activities such as subsistence agriculture.

The loss of economic growth induced by these combined phenomena is estimated to reach 2.2% each year of civil war, all else being equal (Collier & Hoeffler, 2002). Thus with an average length of 7 years, the economy is reduced by 15% compared to his counterfactual. After the war is over, it will take an estimated 14 years for the country to reach his counterfactual GDP, which implies that the costs of the war keep on accumulating once peace is achieved. The present value of the cost of the loss of growth when the war starts is estimated by the authors at 105% of the GDP when using a 5% discount rate.

Huge social consequences add up to the direct economic cost in the loss of GDP, among which a drastic increase of mortality rates but also of the incidence of infectious diseases. The total cost is estimated to an actualized value of 5 millions DALYs (Disability Affected Life Year) at the time when the conflict starts. With a DALY arbitrarily defined as \$1,000, the health costs amount to \$5 billions.

Collier & Hoeffler (2004c) also estimate at 18% of initial GDP the waste associated with the increase in military spending of the government.

2.2 A whole region affected

Murdoch & Sandler (2002) analyze the effect of civil war on the neighbouring countries. The hypothesis is that neighbours face collateral damages from the war occurring next door: destruction of infrastructure; foreign direct investment discouraged by a 'bad reputation' linked to the possibility of contagion; distortions of trade flows in the region.

Empirically, the authors estimated that a one-month increase in the duration of war in a neighbouring country decreases national GDP per capita by 0.4% for the considered year. The presence of a high intensity war (defined by more than 25,000 war-related deaths) leads to a significant fall by 41% of the per capita income. In terms of growth, a country whose neighbour experiences a civil war grows at a rate on average 0.9% lower than a country surrounded by peace. With 2.7 neighbours on average,

²Collier P. & A. Hoeffler, (2006b), 'Civil War', Draft Chapter for the Handbook of Defence Economics, The Journal of Conflict Resolution, 46:3-12, p.23.

the loss in terms of GDP is equivalent in the region to the loss in the war torn country. Applying the same method of calculation as previously, the cost of the war for the neighbours is estimated at 115% of initial GDP. Moreover, as shown by Collier & Hoeffler (2006a), military spending significantly increase in neighbouring countries due to the threat and emulation effects.

Some consequences of civil war are hardly quantifiable, such as the spread of diseases due to movements of population to areas where the local population has not yet developed immunity against it. This probably leads to an underestimation of the effects of civil war.

2.3 At the international level

The consequences of civil wars at the international level are hardly quantifiable.

Among the biggest issues is drug production that tends to be eased in areas outside the control of the national authority. Countries that suffer from civil war somehow provide this favourable environment. In Afghanistan the fall of the Taliban regime has been followed by a significant boost in the production of heroin. Although the counterfactual is uncertain, the social and health consequences of drugs are nevertheless enormous.

Other international issues where civil wars have a role to play are pandemics, along with international terrorism. The relationship between internal conflict and these two important issues have not yet been studied enough to produce a consensus. However, the migration and sexual abuses that often go along with civil war can obviously lead to a quick spread of diseases. Costs of this massive health issue are nevertheless very difficult to assess. The effects of civil war on the international terrorism phenomenon, through providing sanctuaries for planning attacks, can be debated, but the costs are surely astronomic, as illustrated by the 9/11 attacks on New York.

Proceeding to a cost analysis on the reasonably well quantifiable consequences, namely loss of GDP for the country and the region and DALYs loss in the country affected by war, Collier & Hoeffler (2004c) estimated the total cost of a war at US\$ 65 billion³. With an average of two collapses into civil war per year, the overall phenomenon of civil conflict amounts to a clearly underestimated cost of US\$ 130 billion a year, thus justifying an intervention.

Regarding the collateral costs, whether regional or international, they are not integrated by the war protagonists in the decision making-process. They constitute however important negative externalities that need to be integrated in the costs of civil war, but also in the recommendations and strategies of intervention for the international community, particularly once peace is achieved.

³With an average GDP prior to the war of \$19.7 billions: loss of 250% of GDP + \$5 billions in health costs + \$10 billions associated to the trap phenomenon= \$65 billions.

2.4 Reducing the incidence of the civil war phenomenon

The underestimated cost of civil wars of US\$ 130 billion per year to the society seems to justify interventions. Collier & Hoeffler (2004c) identified three ways for the international community to intervene in order to reduce those costs.

Conflict prevention is the politically correct answer and that is what the international community is working on through the development of *Early Warning* systems to detect imminent crisis before they actually occur. However the scope of work to be done is titanic as a lot of countries are at risk i.e. the so-called *fragile states*. Prevention implies tackling the root causes of conflict. Special attention should be paid to redistribution towards the poorest groups and on better transparency on the use of governmental resources to avoid a rise of tensions in the society. More generally what is needed is an adapted development program to enhance growth and reduce poverty.

An alternative way to reduce the costs of conflict is to intervene on the duration aspect: which means resolving the conflict. This is however quite difficult to plan at the political level as it implies the use of force at a national level and therefore infringe on sovereignty. The new development of the doctrine led by the Canadians towards the *Responsibility to Protect* and its recognition at the New York Summit in 2005 increases the scope for suspending the sovereignty of the State if it does not fulfil this responsibility to protect its people⁴. However, the example of the deadly on-going conflict in Darfur underlines that large efforts are still needed. Moreover, Collier, Hoeffler & Söderbom's (2004) empirical results on the study of the duration of civil war show that external military or economic intervention proved to have little impact. Nevertheless, drying the rebel organizations source of revenue by creating a double market for extorted resources has a potential impact to weigh on the feasibility constraint of the rebellion at a remarkably low cost price. The Kimberley Process Initiative⁵ aiming to limit the use of diamonds as a way to finance rebellion provides a good example of such intervention.

A third potential way to intervene is to boost the post conflict recovery. Indeed, as seen before, the costs of civil war (up to half) continue accumulating after the end of combats. According to Collier & Hoeffler's cost-benefit analysis (2004c), this constitutes the best possible intervention for the international community. Indeed, the number of countries meeting the criteria at a time is much lower than all the countries potentially at risk. Among a smaller group of countries, the interventions of the international community can be more focused and efficient than in the scope of conflict prevention.

⁴Conference 'After Leister B. Pearson' co-organized by the Institut Francais des Relations Internationales and the Canadian Embassy, Paris, 2007.

⁵May 2000. Under the growing threat of Global Witness to pursue an information campaign aiming 'blood diamonds', DeBeers, the South African world market leader, agreed on the 'Kimberley Process Certification Scheme', a diamond certification process that allows to track any rock to its source. In 2002, 52 countries had ratified the agreement. Many problems however stand as some diamonds are still illegally exported under certification from non-extracting countries and the Kimberley Process needs enforcement. It is particularly difficult to trace the origin of the alluvial diamonds.

Moreover, as the probability of a new outbreak is significantly higher if the country previously experienced a civil war (see Part 3 on that matter), post conflict intervention can be considered as part of a wider conflict prevention agenda.

It is on this particular type of intervention that this study focuses on. But before proceeding to an empirical work on how to make peace sustainable it is important to understand the specificities of the post conflict environment.

3 Specificities of the post-conflict environment: evidence from the literature

3.1 The ‘Conflict Trap’ phenomenon

It was in 2003 with the World Bank Policy Paper entitled ‘*Breaking the Conflict Trap, Civil War and Development Policy*’ that researchers first associated the concept of a trap with civil wars. The phenomenon is similar to the poverty trap and obvious looking at the figures: in our sample, out of 96 episodes of peace, in 41 cases, the peace collapsed in the first 15 years after the peace onset, 28 in the first 5 years. The ratio is even higher when only Africa is considered. In terms of risks, Bigombe et al. (2000) estimate the average risk of conflict to 22.3% in the 5 years prior to a conflict. It rises to 38.6% in the first years of peace. Hence, the conclusion seems evident: the post conflict environment is conducive to war.

Indeed, what characterizes the post conflict environment is the existence itself of a rebel organization that has once defied the authority and acquired experience in so acting. In 80% of cases, the conflict ends in the victory of the government, and even if the rebellion has been eradicated, such eradication is never total. Peace is also often fragile as rebel capacities erode with time, giving an incentive to the government to violate its commitments to get revenge.

The role of diasporas in financing rebellion in their country of origin can also be exacerbated by the previous conflict. Econometric results (Collier & Hoeffler 2004a) seem to confirm that diasporas play a significant part in repeated conflicts.

But most importantly, what makes the conflict likely to resume is the presence a priori of the determinants of conflict, as a conflict already occurred. These factors have also been worsened during the conflict: growth, the lack of which is a significant determinant of conflict, and the level of per capita income have deteriorated. Development in reverse has translated into an over specialization of the economy in primary commodity exportation as well as in low productive activities. The public sector, including health and education, has been seriously damaged, and foreign investors are clearly lacking⁶. All these variables that have been identified to impact on the risk of conflict (Collier & Hoeffler 2004a)

⁶Empirically, investment is negatively influenced by the perceived risk of conflict (Murdoch & Sandler 2002).

have significantly deteriorated, the direct consequence being a particularly high risk that the conflict will resume. Nevertheless, these indicators should gradually ameliorate as peace is sustained and the risk of conflict should thus decrease overtime. I will discuss later what decreasing path is expected to be followed.

3.2 The post conflict ‘supra-normal growth’ phenomenon

However, if civil war creates a specific environment prone to conflict, a striking dimension of the post conflict context nonetheless is accelerated growth. Hence, Collier & Hoeffler (2004b) identified that controlling for policies, institutions, governance and aid inflows, post conflict economies grow on average at a 1.13 point higher than other economies. The ‘supra normal’ growth does not however follow a constant path but a U inverted one. Indeed, the growth rate is 2% higher than the normal average for developing countries during the second 4 year-period of peace observed and 1.2% during the third 4 year-period. Introducing year-dummy variable into their regression, they identified that the ‘supra normal’ growth occurs between the 4th and the 7th year after the peace onset. The results are only semi surprising as an insecure period characterized by very low level of governance and poor policies⁷ just follows the end of the war. Basic functions of the government need first to be re-established to allow for recovery of the economy.

The conclusion of the study is that this ‘supra normal’ growth is the result of a change in the relationships between aid, policies and growth. One of the reasons stated is that aid might be atypically effective. Hence, if this is the case, it might be worth looking at the impact of aid on the duration of peace, as it could also be particularly efficient to sustain peace.

4 How to intervene to break the conflict trap? : Evidence from the literature

In this study I attempt to assess the impact of aid on the duration of peace in the post-conflict situation. This question has not received much attention so far. A first step is then to focus on the literature on the impact of aid on the risk of conflict, as the method used will be in many senses similar.

4.1 The impact of aid on the risks of conflict: theory and empirical results

To my knowledge there is no consensus existing in the literature as to the impact of aid on the risk of conflict. Two categories of theoretical models are opposite in terms of results depending on the analysis of rent-seeking behaviours in the context of political instability.

⁷Governance and the quality of policies are respectively quantified using the International Country Risk Guide and the Country Policy and Institutional Assessment composite indicators yearly produced by the World Bank.

Grossman (1992) developed the first model that introduced aid inflows in an analysis of the risk of conflict. According to him government and rebels have only one goal that is to loot the resources of the State. Consequently, the bigger the size of the cake associated with victory, the higher the probability of a war outbreak. Hence, aid inflows magnify the size of the cake and thus the incentives for the rebels to engage in a struggle increase as well as the incentives for the government to defend what belongs to it. Consequently aid appears as a destabilizing factor for the region.

On the other hand, Collier & Hoeffler (2002) formulate the hypothesis that rebel groups are not motivated by the rent associated to the capture of the State. Nevertheless they need resources to finance rebellion. In this case, the motive of the rebellion is not greed, but rent-seeking is a condition to overcome the financial viability constraint of the organization under which rebellion cannot occur. Aid inflows do not allow the financial viability constraint for the rebels to be relaxed, as aid is hardly appropriable during conflict⁸. Moreover aid engagements drastically fall in time of political instability. The authors emphasize the fact that the effect of aid according to Grossman is conditional on a rebel victory that occurs in only about 20% of the cases (Collier & Hoeffler 2002). Therefore the rent appropriation conditional on victory will be heavily discounted in the rebel decision-making calculation. On the government side, aid relaxes the government budget constraint that can therefore increase its level of deterrence. Consequently this tightens the financial viability constraint of the rebels and thus decreases the risk of engaging in conflict⁹. Collier & Hoeffler (2002) identify two other routes through which aid can influence the risk of conflict: through its effect on growth and through its impact on the structure of income of the economy i.e. aid can have an effect on the diversification of exports.

A priori, the impact of aid on the risk of conflict is undetermined either positive if Grossmans effect is verified, or negative if the theory developed by Collier & Hoeffler is correct. There is also a possibility of the two theories being validated, leading to an ambiguous relation between aid and conflict. Empirically, the authors add aid as a ratio of GDP, firstly corrected for endogeneity, to the standard logit regression of the risk of war to observe any impact. The coefficient of the variable of interest is not significant. The two effects seem thus to compensate each other. However, the indirect effects of aid via the impact on growth and the change in the structure of income reveal to be significant. It is interesting to recall the work of Arcand & Chauvet (2001) who reach a different conclusion using an alternative sophisticated model on rent-seeking behaviours. They highlight the stabilizing role of aid inflows whereas their characteristic uncertainty is identified as destabilizing. Moreover aid seems to operate through a Grossman effect and not necessarily through an effect on growth as suggested by Collier & Hoeffler.

⁸It is important to notice the particularities of humanitarian aid. Many studies have indeed underlined that it is easily lootable by the rebel group and can serve as a payment for the soldiers. Redistribution to the population can also ensure rebels a certain legitimacy.

⁹For more details on the modelization see Collier & Hoeffler (2002), pp.338-339.

Yet a consensus has not clearly been reached on the effect of aid on the risk of civil war although results seem to suggest a stabilizing effect. A question appears then evident: what is the impact of aid in post conflict situations: does it stabilize the newly peaceful country or does it make the war more likely to resume? It is important to recall that aid has been identified as playing a significant role in post conflict ‘supra-normal’ growth, underlying its specificities in post conflict environment. Hence, aid might also have a particular impact on peace duration.

4.2 Peacekeeping Operations

If aid can help growth to rebound, its effects can only be observable in the medium to long term. Indeed, economic recovery takes many years. Thus, in the immediate aftermath of war the principal means by which the international community can seek to maintain peace and security is by sending military troops. The research on peacekeeping operations is however still relatively poor. A particular characteristic of UN peacekeeping operations¹⁰ is the widely different mandates under which they can operate, ranging from simple observation to traditional missions under the Chapter VI of the UN Charter, to peace enforcement operations under the Chapter VII of the UN Charter.

Empirically, high military spending raises the risk of renewed conflict (Collier & Hoeffler 2006a). However the level of defence needs to be just high enough to deter the breaking of the peace agreements. Bargaining is needed. Theoretically, presence of international troops can play a deterrence role on the rebel organization without impacting the risk of conflict. On the side of the government, it decreases the incentives to over invest in the defence sector.

Empirical results are mitigated. Doyle & Sambanis (2000) find a negative impact of multidimensional peacekeeping operations on the risk of conflict. Hartzell et al. (2001) and Collier, Hoeffler & Söderbom (2006) reach the conclusion that external military presence enforces peace. Fortna (2004) estimated that the presence of international staff reduces the risk of war reversion by 84%. Contrarily, Dubey (2002) concludes that sending peacekeeping forces has no impact whatsoever.

An important problem, however, associated with estimating the effect of peacekeeping operations is their endogenous character regarding the intensity of conflict. Indeed, Fortna (2004) shows that UN peacekeepers tend to be mostly sent to situations where no side clearly won and when conflicts have reached particularly high levels of casualties, i.e. the most difficult and insecure cases. Thus, peacekeeping operations could appear to fail to sustain peace whereas the situation faced was difficult and war would have resumed anyway. The endogeneity of the variables need therefore to be controlled for. Nonetheless, no instrument so far proved to be appropriate. Consequently, results will probably undermine the impact of such operations.

¹⁰The United Nations is the principal organization sending peace keeping troops, but recently NATO, the European Union and other regional organizations have implemented such operations.

5 Dataset

Civil war is a complex multidimensional phenomenon. Indeed each conflict is unique as it is widely linked to a specific social, economic and political context and the history of the nation itself. Hence a universal definition leads to theoretical problems but is *de facto* needed to allow for a theoretical and empirical analysis of the phenomenon. The debate on the best definition of civil war is wide, and a significant number of databases are available for researchers¹¹. Each definition imposes slightly different ad hoc hypotheses that will potentially impact the results directly and significantly.

For the purposes of this study I decided to use the newly updated ‘UCDP/PRIO Armed Conflict Dataset’ (Version 4-2006) with the intermediate intensity definition (a minimum of 25 war-related deaths per annum corresponds to a *minor conflict*; if the casualties reach 1000 over the entire duration of the conflict then the intensity level is defined as *intermediate*; if there are over 1000 conflict-related deaths it coded as *war*). The definition of violent conflict allows distinguishing between four different type of war: *extra-systemic conflicts*; *interstate wars*; *intrastate wars*; *internationalized intrastate wars*. The last two were used to define the peace periods of the sample. However, it is important to note that the intensity level of the coded conflict for each year is an aggregate that does not take into account the dates of beginning and ending of the hostilities. This leads to uncertainty on the date at which the threshold is reached.

The data for our study only includes post-conflict countries: to be considered a country has to have experienced a civil war between 1945 and 2005. A country *i* will enter the sample when the first year of peace after the conflict is observed, it will exit the data when failure occurs, namely if and when war resumed. Thus 52 countries are concerned and 96 peace episodes are observed over the period 1960-2005¹². The maximum peace duration was arbitrarily set to 15 years considering that after this period of time a country cannot be considered as post-conflict.

5.1 Variables of interest

The variable of interest in this study is Official Development Assistance as defined by the OECD-DAC reported to the GDP of the country¹³. One-year lagged values are used to take into account that the

¹¹See Sambanis (2004) for more details on the different databases.

¹²Due to the lack of data of explanatory variables before 1960 the period of observation could not cover 1945-1960. However, in order not to lose peace periods, the intervals were defined using all the information provided by the CAD since 1945. Hence, if country *i* experienced a war from 1949 to 1951, it would consequently record in 1960 its 9th year of sustained peace. Thus some observations are censored on the right.

Note that the war in the United Kingdom (vs. the Irish Republican Army) and the war in French Algeria were not included in the sample as both are developed countries. The so-defined civil war in the USA in 2001 is also dropped as it the only result of the casualties of the 9/11 attacks on NYC.

¹³Flows of official financing administered with the promotion of the economic development and welfare of developing countries as the main objective, and which are concessional in character with a grant element of at least 25 percent (using a fixed 10 percent rate of discount). By convention, ODA flows comprise contributions of donor government agencies, at all levels, to developing countries (‘bilateral ODA’) and to multilateral institutions. ODA receipts comprise

effects of aid, whether positive or negative, are not immediate. The squared values are introduced to capture eventual decreasing returns to scale.

A dummy, equal to one if a UN peacekeeping operation was sent and zero otherwise, was utilized to capture for the possible influence of a peacekeeping operation on peace duration¹⁴. The binary form of the variable leads to a huge simplification of the reality regarding the variation in the budget, staff and mandates of the different operations that were conducted since 1960. Furthermore, other organizations missions (NATO, EU) are not included in the data. However, the impact of sending peacekeeping forces being not the focus of this study, a dummy was an easy way to capture it, more detailed data on the subject being not available. Another problem, mentioned earlier, associated with the peacekeeping operations variable is that it is highly suspected of endogeneity. Indeed, history seems to prove that UN forces are sent in the most difficult and desperate cases i.e. when the war has been extremely violent and destructive. Then, a UN peacekeeping operation would appear as a factor of renewed conflict. Nevertheless, no instrument to correct for endogeneity has been identified so far.

I used different proxies to capture the possible economic, social, political and geographical determinants of the onset of a renewed conflict. As the causes of the outbreak of a new war are surely very similar, with possibly some differences, the same variables as in the previous literature were used if available (Collier & Hoeffler 2004a).

5.2 Economic variables

The logarithm of per capita GDP serves as a proxy to the cost of recruitment for the rebel group. Indeed, if opportunities are very low, economic agents will accept to engage in the army at a low wage. Hence, the financial viability constraint is released and the organization is more likely to engage in rebellion. The level of per capita income raises significantly the risk of war (Collier & Hoeffler 2004a); the sign of the coefficient should therefore be negative.

It is important to underline that the occurrence of a previous conflict impacts badly on the level of GDP per capita. Moreover, it is likely that this level might be affected by the imminence of a new outbreak. An alternative proxy of the economic opportunities could rely in the state of the education system. A more informed variable than the commonly used rate of enrolment in secondary school for young boys is the child labor rate. The substitute measure sadly corresponds to the reality of recruitment of child soldiers. However, data on schooling is rather poor in countries of the sample.

disbursements by bilateral donors and multilateral institutions. Lending by export credit agencies with the pure purpose of export promotion is excluded'. (IMF 2003)

¹⁴The list of operations performed by the United Nations is available from the website: www.un.org. Note the presence of an operation since 1949 at the border between India and Pakistan. The objective of the mission being the surveillance of the cease-fire, it is not included in the database. Note as well that the UN mission dedicated to verify the respect of the cessation of hostilities between Ethiopia and Eritrea is not considered in the data regarding the international dimension of the conflict.

Another commonly used variable in the literature on civil war is the growth rate of the economy. It allows also capturing for economic opportunities. We expect that the higher the growth rate, the lower the risk of renewed conflict via a direct but also an indirect effect, through the impact on the GDP per capita level. Again the variable is suspected to be endogenous to the incidence of the war. There is also a potential positive effect of aid inflows on the per capita growth rate. The variable should therefore be instrumented otherwise its introduction in the regression would possibly lead to an understatement of the effect of aid on the duration of peace. Finding adequate instruments for per capita growth however proved problematic. A landlocked dummy as well as the log of the sum of the distances to Washington, Tokyo and Brussels to capture the geographical distance to European, North American and Asiatic markets were used.

The primary commodity export over GDP ratio is also associated to the capacity to finance the rebel organization. Indeed, primary commodities have proven to be easy for the rebels to loot and to exchange, most commonly on the black market. The examples of the financing of the RUF in Sierra Leone or UNITA in Angola by looting the countrys diamonds resources are striking. It can also capture peoples perception that these resources are badly managed by the government. Empirical results from the literature shows that it carries an important explanatory power in predicting the risk of conflict (Collier & Hoeffler 2004a). The effect is non linear with a danger pick around 30-35% of GDP. The closer to this ratio, the higher the probability of a war outbreak.

The ratio of exports of primary commodity is constructed as an aggregate of ores and metals exports, agricultural exports and fuel exports rapported to the national GDP. A problem lies however in the fact that a significant amount of observations is lost by introducing this variable in the regression. In order to limit this loss and the possible bias thus created towards the richest countries of the sample, missing observations were replaced by the national mean calculated over the entire period of study. A dummy variable equal to 1 was introduced if the observation was originally missing. This implies a reduced precision but allows for a higher number of observations in the sample and therefore to a more precise estimation of the impact of the variables of interest.

Collier & Hoeffler (2004a) also identified the size of the diaspora to potentially influence the risk of conflict via flows financing the rebel group. This might even more be the case in the post conflict context, as a decent amount of people will have attempted to leave the country as the violence started or intensified. Obtaining data on the size of diasporas is tricky. I therefore decided to use the amount of remittances received by the country over the GDP as a proxy. Far from being the panacea, the size of the diasporas might however not be correlated to the amount of remittances. For that particular matter, the proxy will not be part of the regression of reference.

5.3 Social dimension

Another dimension of the post conflict situation is that the war can leave a heavy heritage of hatred in the society, potentially making the reengagement of soldiers in the rebellion easier. If hatred does not significantly impact the risk of conflict, the situation might be different in a post conflict environment (Collier & Hoeffler, 2004a). The integration of social variables in the regressions allows capturing for the hatreds between groups inside the society and therefore permits to identify if these grievances influence the risk of renewed conflict.

The ethno-linguistic fractionalization index is of central interest in the analysis of the determinants of conflict. It estimates the probability of two individuals not to speak the same language. The squared index is introduced in order to capture a non-linear effect.

5.4 Political variables

A dummy for the Cold War period is needed to capture the opportunities of finance coming through support of governments enemies in the Cold War context. It takes the value of one before 1990 and zero otherwise. As for the determinants of war, the Cold War period is expected to positively influence the risk of renewed conflict, therefore decreasing the prospect of sustainable peace.

An index of the democratic quality of the regime is also necessary. The most commonly used is the Polity IV index (Gurr et al., 2005). It varies from one to ten, at zero value the country being an autocracy and at ten the country a complete democracy.

Introducing an indicator of good policies is essential to an analysis of the effect of aid on peace duration. Collier & Hoeffler (2002) use the Country Policy and Institutional Assessment, which is a composite aggregate of 20 equally weighted policy components. However, the CPIA has only recently been made available for non World Bank staff and this only for recent years. An alternative therefore had to be chosen. The utilization of the International Country Risk Guide, measuring the quality of governance, was rejected as it engenders the loss of all observations prior to 1984. The inflation rate of the General Price Index is very well informed over the study period and looks like the best alternative. However, precaution is necessary using the inflation rate variable due to the potential effect of aid inflows on inflation in post conflict environment. Indeed, the findings of Adam, Collier & Davies (2006) underline the effect of aid inflows in decreasing the need for seigniorage in post conflict situations and thus leading to a significant decline in the inflation rate. Nevertheless, considering that the aid inflows are instrumented, the introduction of the inflation rate in the regression of the duration of peace is believed not to alter or bias the results. The value of the external balance was also considered.

Variables were also introduced to capture an eventual effect of executive elections. These are not

present in standard regressions in the literature on the determinants of conflict but it appears important in post conflict situations to take into account such information. We follow Collier, Hoeffler & Söderbom (2006) and capture the effect of an election switch on the post conflict risk of civil war by introducing a variable taking the value of -1 prior the year during which this elections took place, 1 during the year of the elections and 0 otherwise. The intuition is that the year before the elections, both parties are focusing on winning peacefully, and then elections happen to leave a loser who might be willing to regain power through fighting. The data however only covers until 2000.

We also introduced variables to capture the effect of the history of war, namely the duration, in years, of the civil war, and a dummy if the country enters the sample for the second time *i.e.* the country has experienced at least another war than the one just over at time t .

5.5 Geographic characteristics

The surface of the country is used, as in the literature, to indicate the capability of rebels to organize an armed movement. In a larger country it is more likely that some territories would be outside the control of the national government.

6 Empirical model and regressions

6.1 Duration model

Looking at the incidence of aid on the duration of peace implies using a specific method, as the dependent variable is a length of time, namely survival analysis.

The economic specification is a continuous time hazard model of the yearly transition from peace to war. The transition rate from peace to war for a country i after a previous state of peace of l is represented by the hazard function defined as:

$$h(y_{li}/X_{li}; \theta) = f(y_{li}/X_{li}; \theta)/S(y_{li}/X_{li}; \theta) \quad (1)$$

where $f(y_{li}/X_{li}$ is the density function, $S(y_{li}/X_{li}; \theta)$ the survival function, X_{li} a vector of explicative variables and $\theta \in \mathbf{R}^P$ is fixed for the corresponding sample. By definition, the survival function can by definition be written as:

$$S(y_{li}/X_{li}; \theta) = f(y_{li}/X_{li}; \theta)/h(y_{li}/X_{li}; \theta) \quad (2)$$

The likelihood function is represented by:

$$L_i(\theta) = \prod_{l=1}^{t_i} f(y_{li}/X_{li}; \theta)^{\delta_{li}} S(y_{li}/X_{li}; \theta)^{1-\delta_{li}} \quad (3)$$

where $\delta_{li} = 1$ if duration is fully observed and 0 otherwise.

Computing (1), (2) and (3) we can rewrite the likelihood function as:

$$L_i(\theta) = \prod_{l=1}^{t_i} h(y_{li}/X_{li}; \theta)^{\delta_{li}} S(y_{li}/X_{li}; \theta) \quad (4)$$

In order to run the regressions we need to choose a functional form of the hazard function. However, a difficulty arises: we cannot assess a priori how the risk of non-failure, i.e. the war not resuming, evolves over time. Nevertheless choosing a particular hazard function form will impact the results. Intuitively, we can think that as time passes, the risk of a new collapse into war drops, but it might well not be the case. The risk can vary also vary overtime, or stay constant. The literature focusing on post conflict risks is still poor at this early stage. If Collier, Hoeffler & Söderbom (2006) use an exponential distribution, others might prove more appropriate.

In order to decide the appropriate functional form to use, a first step is to look at the graphics of the Kaplan Meier estimate and the smoothed hazard estimate corresponding to our data. The results speak for themselves: if anything, the risk of failure is not constant over time and does not evolve proportionally. Looking particularly at the hazard estimate graph, it seems like a logarithmic functional form would suit the data a lot better (figure 1).

To best determine the best fitted model, I compared the values of the Akaike Information Criterion calculated using log-likelihoods obtained while running the reference regression with the different models (Table 2). The results confirm the previous intuition that a logistic distribution best fit the data¹⁵. The conclusion appears to be that the risk of failure first increases and then decreases. This can be explained simply. During the early period following the peace onset both parties are willing to leave peace a chance or one side might be too severely bitten to reengage in violent activities. As time passes however, each side starts to be able to assess if commitments will be held by the other. In the case where one of the armies has been defeated, it cannot obviously return back to war straight away but some time is necessary to reorganize. Once the strategic ‘high-risk’ period is overcome then the risk of war resuming continuously falls.

Having now decided to use the lognormal distribution the equations above can be rewritten as:

¹⁵Note here that the AIC value concludes for the use of a lognormal distribution, however the use of this distribution leads to a certain number of regression not converging, reason why I opted for the log-logistic distribution. Recall that both leads to very similar results

$$S(y_{li}/X_{li}; \theta) = 1 - \phi\left(\frac{\ln(y_{li}/X_{li}; \theta) - \mu}{\sigma}\right) \quad (5)$$

where $\phi\left(\frac{\ln(y_{li}/X_{li}; \theta) - \mu}{\sigma}\right)$ represents the repartition function of the centered and reduced normal law $\mathbf{N}(0, 1)$ with $\sigma > 0$ the standard deviation.

With a log-log distribution, the probability density function becomes:

$$f(y_{li}/X_{li}; \theta) = \frac{1}{\sigma\sqrt{2\pi y_{li}}} \exp\left[-\frac{1}{2}\left(\frac{\ln(y_{li} - \beta X)}{\sigma}\right)^2\right] \quad (6)$$

and as before the hazard function can be written as the fraction of the density function over the survival function:

$$h(y_{li}/X_{li}; \theta) = f(y_{li}/X_{li}; \theta)/S(y_{li}/X_{li}; \theta) \quad (7)$$

6.2 Correcting for endogeneity of the aid variable

Aid is suspected to be endogenous to the countrys war history. Indeed donors often allocate aid depending on the stability of the political and institutional environment. If the results of the Burnside & Dollar analysis (2000) stating that aid is more efficient in countries with good policies have been widely criticized, countries with the best policies still receive on average more aid. Hence, this will textitde facto exclude a large amount of the countries in the data. However, when the war is just over, aid inflows have proven to significantly increase, probably due to the focus of the world media. This is particularly true in our data as shown by the average annual aid inflows depending on the number of year since the peace onset (Table 1). It is therefore necessary to instrument the aid variable to avoid biased results.

The method used (Tavares 2003) consists in creating variables that can affect the aid ratio received by a country i but are exogenous to the quality of its institutions. The idea behind is that when donors modify their aid budget, often for internal budget reasons, the receiving countries, close geographically or culturally, observe an exogenous change in the amount of aid allocated. Instrumentation needs many steps. For the five biggest donors (the USA, the UK, France, Germany and Japan) four variables indicating political, geographical and cultural proximity with the receiving country i are gathered: a variable indicating the affinity of vote at the UN General Assembly (at the exception of Germany for which this variable is only documented after 1989), the inverse of the distance to the donor countrys capital city (for European countries, distance to Brussels is used) and two dummy variables taking the value of 1 if the official language and the religious majority are the same¹⁶. Each of these variables is weighted by the corresponding donors total aid budget (source: OECD/DAC).

Two steps follow: the ratio of aid/GDP is first regressed using these 19 instruments described above.

¹⁶The UN affinity vote data originate from Gartzke (2006), the binary variables and geographical distances to capitals were made available by Lisa Chauvet.

In order to minimize the number of instruments used, the dependent variable is then regressed again dropping the instruments that appeared to have no significant effect in step 1 (Table 6). This allows obtaining a predicted value of aid/GDP purged from its endogenous character vis-à-vis political instability of the receiving countries.

6.3 Regressions

I ran different regressions slightly modified from the reference one (Table 3- column (1)), each time using a log-logistic parametric model. Each regression includes dummy variables defining 4 episodes of 2 years of peace considered until the 8th year. However the last one is dropped to avoid multicollinearity. The results are reported in Table 3 in the Appendix. Aid is instrumented using the Tavares (2003) method described earlier (Table 6) and the growth rate is included as instrumented using the distances to the market and the landlocked aspect (Table 7). Column (2) corresponds to the study of the agenda of aid allocation. In column (3), aid ratios, instrumented, are interacted with the peacekeeping dummy in order to detect a possible conditional effect of aid. In column (4) dummy variables were added to the standard regression for the presence of executive and legislative elections shifts; in column (5) and (6) the shifts are introduced on their own. Finally, I introduced the logarithm of the amount of remittances received by the country over GDP ratio in column (7), proxy for the size of the diasporas.

6.4 Robustness checks

The data suffers from an evident selection bias due to the fact that only countries that previously experienced a civil war are considered. This can lead to an overestimation of the effect of aid in post conflict situations as those countries have specific characteristics that increased the likelihood of collapsing into civil war. These countries might be among those where aid inflows are particularly efficient anyway. This selection bias needs to be checked and corrected for if necessary in order for the results to be valid.

To correct for the selection bias of the sample, I calculated the probability of observing a first year of peace following a civil war using as a model the analysis of the duration of war by Collier, Hoeffler & Söderbom (2004). A logistic approach was taken as opposed to the original exponential survival analysis model. The dataset is augmented with lower income countries as well as lower and upper middle-income countries as defined in the WDI2006s income groups. The regression was kept as close as possible to the one of the duration analysis and the same explanatory variables were introduced when available (Table 5). Computing the probabilities, the predicted probability of observing the first year of peace was calculated for each year of actual peace onset¹⁷. These values were then introduced into the core regression of the analysis of peace duration to correct for a possible selection bias (Table

¹⁷The probability of being selected into our sample is defined as such: $proba_t = (1 - p_t)p_t$ where p_t is the predicted probability of a peace onset to occur on a given year, calculated by the logit regression and $proba_t$ corresponds to the one observed then the country actually entered the sample i.e. taking into account the time dimension ($t_0=1960$).

4, column (2) in the appendix). We cannot reject the hypothesis that the coefficient of the probability is null, meaning that the data suffers from a selection bias. However, most importantly, the coefficients of the aid variables are only slightly modified and the threshold stays the same.

Acknowledgement of the remaining problem that a country could experience multiple episodes of peace should nonetheless be made. The problems stands in the fact that the probability of entering the data used would the same for the first episode of peace as for the subsequent ones. This concerns 11 out of 52 countries that appears in the regression sample to have more than one episode of peace, which is relatively substantial.

Different tests were also performed to verify the robustness of the results.

I rerun the core regression restricting the sample to a maximum of 10 years of peace to be certain that the results do not only stand because of the 15 years of peace arbitrary definition of the post-conflict period. Results are similar. It is worth noticing however the coefficient of the PKO dummy is a lot smaller than previously (Table 4, column(1)).

I used the one-year lagged value of income per capita to check that the use of the per capita income did not bias the results in the first place (Table 4- column (3)). The coefficient of the lagged variable appears significant and the threshold of aid inflows is not modified.

China and India were eliminated from the sample to check if their presence was first altering the results. It is possible that, because they are large and heavily populated countries with however quite localized internal conflicts, their introduction in the regression led to a significant bias in the results (Table 4- column (4)). In both cases, results were not altered.

I also used a alternative indicator of the quality of democracy without significant modifications in the results (Table 4- column (5)).

The fact that a significant number of observations are missing, due to a typical lack of data in such countries, leads to also consequences that are not insignificant. First of all, an important number of peace episodes are therefore dropped from the regression (more than half). The results are thus less robust as the number of observations shrinks. Secondly, it is likely that poorer countries have bad quality of data collection leading to a bias towards richer countries, as information would be better and likely less often to be missing. An interesting way to correct for missing data is to use the Amelia II software (King et al., 2001) to fill the gaps. Amelia performs multiple random imputations for missing values of selected explanatory variables, creating thus five datasets with filled missing values. I then reran the regressions of the duration analysis with the imputed databases (Table 8).

7 Interpretation of the results

7.1 International interventions

Aid appears to be highly significant in increasing the duration of peace. In the post conflict environment, it seems thus that the Grossman theory is invalidated; on the contrary aid appears to improve stability. However, the supposed presence of diminishing returns to scale is confirmed. The threshold calculated using the results of column (1) of Table 3 reaches 4.83% of the GDP . Up to this percentage, the marginal impact of aid on peace duration decreases. The calculation of the threshold using other regressions leads to similar results. In the data, the average ratio of aid to GDP received by the countries in post conflict situations barely reaches 2.5% (2.27%). It is also interesting to notice that, for about half of the years of peace observed (409/772) the ratio of aid to national income lies below 4.83%¹⁸.

The recommendation for the aid community is then straightforward: aid is highly efficient in making peace sustainable; the disbursements should therefore increase during the post conflict period. In fact, they do increase as shown by the data, but not enough and not in a sustainable way over the period. There is indeed a relatively sharp increase of aid inflows in the immediate aftermath of the onset of peace, probably as a consequence of the media influence, but then the trend rapidly decreases to a below-average ratio. An easy way to understand the impact of the result is to graph the predicted hazard ratios fixing the aid inflows to the values of interest and compare the plots obtained to the predicted hazard plot of the sample (Figure 2). Comparing with the plot of the mean hazard ratios from the sample, it appears indeed obvious that allocating aid at the threshold of 4.83% significantly decreases the risk of a renewed collapse into civil war, notably in the first 5 years of peace *ceteris paribus*.

With an average GDP for the entire data set at just over US\$ 112billion PPP, US\$5.4 billion would be needed for the average country i to reach the threshold. Investment seems worth it regarding the titanic 65 billion cost of a sinking into civil war again. For the lowest GDP of the data, namely US\$979 million (Guinea-Bissau, 1999), just about US\$50 million would be needed to reach the best efficient amount of aid. More strikingly, over 9.65% of GDP, aid appears to reduce the probability of sustained peace. Interestingly, 30 observations out of our dataset show aid inflows over 10% of GDP, underlining both the waste of money for donors and the probable negative effects for the receiving countries. As a conclusion of this observation, the international community could intervene efficiently to maintain peace with relatively small flows of aid. Indeed, sending massive inflows of international aid, as it seems to be the case in some countries, does not appear as the appropriate solution to make peace sustainable; there is only a certain amount that can be absorbed. Over this threshold, aid appears to weaken peace, thus validating Grossmans theory of the negative effects of aid.

¹⁸The results after multiple imputation are not significant, however the threshold calculated is very close to the one from Table 3

Another interesting result is the highly significant and positive effect of the presence of a UN peacekeeping intervention. Such intervention seems on average to increase the probability of peace by about a factor of six, everything else being equal (Table 3- column (1)). Nonetheless, this strong effect does not stand with multiple imputations (Table 8). Indeed, the coefficients tend to decrease to much reasonable values but they lose significance. This difference in the coefficients might be explained by the fact that our sample used in Table 1 disproportionately accounts for peacekeeping operations. Acknowledging the poor precision of the dummy, the approximation is rather difficult, but if anything the positive effect of peacekeeping troops is confirmed in our core regression, as found by Collier, Hoeffler & Söderbom (2006).

Now focusing on the interaction term between the aid variable and the UN peacekeeping dummy, sending blue helmets appears to increase the level of the threshold discussed above to 14.7% (Table 3, column (3)). The combination of aid and peacekeeping operations looks like the best answer to stabilize the post conflict environment and strengthen peace¹⁹. Recall as stated earlier that the presence of UN peacekeeping missions should potentially be corrected for endogeneity. However, no possible instrument has been identified in the literature.

In terms of aid agenda allocation, the results are woollier. The interacted terms with the 2-year peace period dummies appear significant and positive in Table 3, column (2) and we can reject the null hypothesis that the coefficients are no different from each other. The coefficients slightly increase as time passes when the coefficients of time dummies are negative and as well increase over time. This leads to the conclusion that aid becomes more effective after the first 2 years of peace, often characterized by instability. At this stage it is impossible to describe the more appropriate agenda of aid allocation to improve the prospect of sustainable peace. The wiser decision, however, seems to follow the results of Collier & Hoeffler (2004c) which leads to the conclusion that aid is surprisingly highly effective to rise growth between the 4th and the 7th year after the peace onset.

7.2 Other results

The coefficients of the growth variable and the logarithm of GDP per capita are positive but not always significant. Yet this tends to confirm the unsurprising result that a higher level of economic opportunity works as a stabilizer in the highly fragile post-conflict environment. And effective development strategy is needed to stabilize the country.

The inflation rate does impact negatively and significantly the duration of peace; however the effect is nonetheless negligible. This suggests that the higher the inflation, the less stabilized the

¹⁹The results obtained after multiple imputations tend yet to contradict the previous results

environment. It is however worth recalling that this indicator is certainly not the best to capture the effect of ‘good policies’ and further investigation might lead to a different result. Using the Country Policy and Institutional Assessment from the World Bank, Collier, Hoeffler & Söderbom (2006) also found an insignificant effect on the duration of post-war peace.

The coefficient of the democracy variable tends to be negative and significant in some regressions. That results seems at first counterintuitive; however one must recall that most of the countries in the sample would display bad ranking in terms of democracy. Hence, when the democracy rate improves on the 1 to 10 scale it is likely that the country experiencing this move towards democracy will be going closer to a transitional state which might well be less stable than either a full autocracy or a full democracy.

We can assess the impact of the remittances, proxy for the size of the diasporas, only with limited precision due to the high number of missing observations. A higher relative level of remittances seems to decrease the probability of peace being sustained quite strongly, but the correlation is not significant. This result is in line with the findings of Collier, Hoeffler & Söderbom (2006), using an alternative measure, that the size of the diasporas significantly lowers the duration of post-war peace. The results after running Amelia tend to confirm the tendency although, again, the coefficient is not significantly different from zero. It is however likely that the remittance variable is endogenous to the intensity of the previous conflict: the more violent, the more people fleeing out of the country. It could also be the case that peaceful countries have a longer history of money transfer from abroad. This should be corrected for in order to obtain better results. However, if finding a good proxy for the influence of the diasporas is tricky, so is its instrumentation.

The occurrence of executive and legislative elections shifts does significantly impact the duration of peace when both are entered together in the regression, although the coefficients are interestingly different (Table 3, column (4)). This does not confirm the results of Collier, Hoeffler & Söderbom (2006) that prior to the elections peace is more stable, but once the election process is over, the environment tends to become more risky. It is yet worth noticing the loss of observation points induced by introducing the variable. Moreover when introduced on their own (columns (5) and (6)), the coefficients are no longer significant.

Examining next the effect of the dependency of the economy on primary commodity exports, the results are in line with the existing literature on conflict risks. The coefficients suggest a U-inverse shaped impact of the primary commodity ratio over the probability of peace as captured by the decreasing returns to scale. It seems like primary commodity export dependency increases the probability of a conflict recurring with a maximum effect at 76% of the GDP. This appears particularly high. However, recall that the coefficients are not always significant and missing values have been filled with the average of the country dependency over the entire period under study thus limiting the accuracy of the results.

The legacy of history, namely the duration of the civil war and whether the country experienced more than one conflict, does not impact the results significantly. It is however worth noticing that the coefficients show the expected negative signs.

8 Conclusion

Post-conflict interventions represent an interesting tool for the international community to prevent violent conflict from reoccurring and promote peace as a world public good. Indeed, pushing countries out of the ‘conflict trap’ seems to be an effective way to reduce the scope of the entire civil war phenomenon.

In this study, I assessed the effect of ODA inflows on the duration of peace after a civil war using survival analysis. The results are striking: aid does increase the length of post-conflict peace with, however, decreasing returns to scale. The threshold is observed around 4.8% of the national GDP using the reference dataset and is robust to different tests performed. Hence, only quite small amount of aid would be effective to increase peace. Donors should therefore take into account the specificities of the post-conflict environment and design their aid allocation accordingly. The data shows the evident differences between the best practices derived from the results and the reality of aid allocation to post-conflict countries. Massive flows of aid straight after the peace onset, as it is sometimes observed, do not fit in the most efficient aid allocation agenda and neither do the most often to low international involvement. Interestingly, I observed a positive and significant impact of UN peacekeeping operations on the duration of conflict, although the fragility of the results calls for a deeper analysis. Furthermore, combined with aid inflows the probability that peace would be sustained seems to increase significantly when blue helmets are present in the country.

Nevertheless, it is of importance to acknowledge that the use of the econometric method cannot take all diverse aspects of the complexity of civil war and post-conflict environment. I believe however that economics throw an interesting light on the best way to intervene to make peace sustainable. Combined with case studies it could give a decent basis to analyze the best practices to prevent conflict from reoccurring.

Appendix

Variables

Peace duration: number of years of peace since the conflict ended (the maximum duration of peace is arbitrarily set at 15 years as we considered than after such a period if a war resumes than we cannot considered that it is the same conflict).

Aid/GDP: I used the disbursements amounts of Official Development Assistance and Official Aid in current \$US per destination provided by the OECD-DAC. The GDP data is issued from the World Development Indicators 2006.

GDP per capita growth: in percentage, source: WDI 2006

Real GDP per capita: constant prices: Chain series (International \$2000 constant prices), source: UPenn World Tables (rgdpch)

External balance: External balance on goods and services (% of GDP), source: WDI 2006

Inflation rate: Inflation, consumer prices (annual %), source: WDI 2006

Merchandises exports: Merchandise exports in current US\$, source: WDI 2006

Agricultural exports: Exports of agricultural raw materials (% of merchandise exports), source: WDI 2006

Fuel exports: Fuel exports (% of merchandise exports), source: WDI 2006

Ores and metals exports: Ores and metals exports (% of merchandise exports), source: WDI 2006

Primary Commodity Exports: sum of the agricultural, fuel, ores and metals exports (in current \$US) divided by the national GDP (in current \$US), source: WDI 2006

Refugee population: Refugee population by country or territory of origin, source: WDI 2006

Remittances/GDP: Workers' remittances and compensation of employees, received (US\$), source: WDI 2006 - The GDP data is issued from the WDI 2006.

Land: Surface area (sq, km)

Sub Saharan Africa: dummy equal to 1 if the country is located in Sub Saharan Africa

Landlocked: dummy equal to 1 if the country is landlocked, source: Easterly & Levine

Ethno-linguistic fractionalization: source: Easterly, Levine

Index of democracy, autocracy, polity and polity2: source: Polity IV dataset

Election shift: takes the value 1 if there was an election of the executive/legislative during the observed year and -1 for the following year. Source: DPI, World Bank, Phillip Keefer.

Table 1: Average annual aid inflows depending on the time sine peace onset

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ODA/GDP	2.52	3.18	3.11	2.56	2.56	2.18	1.83	1.91	1.60	1.69	1.69	1.56	1.44	1.21	1.20

Figure 1: Graphics prior to estimation

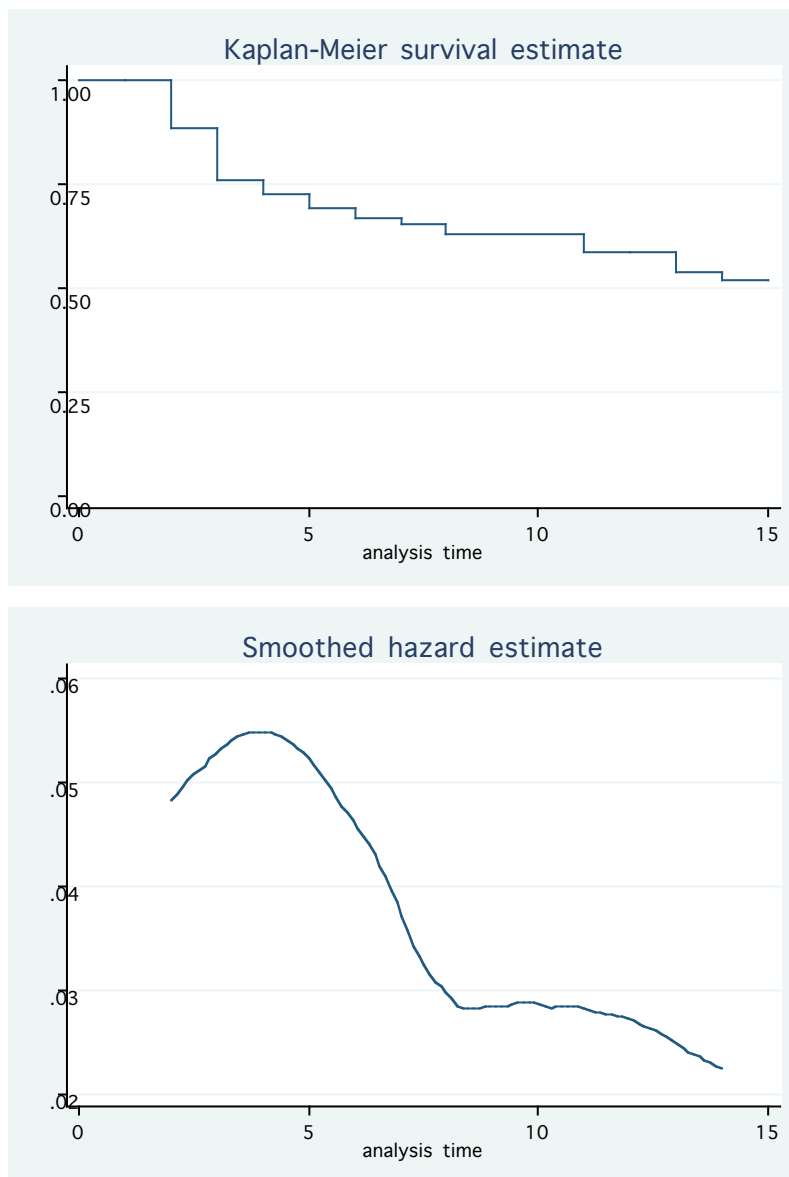


Table 2: Choosing the best hazard distribution - dependent variable: duration of peace

	exponential	weibull	lognormal	loglog
	(1)	(2)	(3)	(4)
ODA/GDP_{t-1}	.118 (.485)	-.391 (.610)	.030 (.047)	.038 (.053)
ODA/GDP_{t-1}^2	-.020 (.044)	.023 (.059)	-.0009 (.004)	-.002 (.005)
Growth	-.176 (.121)	-.229 (.139)*	.021 (.009)**	.020 (.012)*
Ln GDP per cap	-2.418 (.929)***	-3.300 (1.242)***	.307 (.088)***	.292 (.113)***
Ln inflation	.062 (.181)	-.065 (.296)	-.003 (.019)	-2.35e-07 (.028)
Iry commodities exports/GDP	3.775 (1.444)***	5.968 (2.935)**	-.473 (.150)***	-.488 (.178)***
Iry commodities exports/GDP ²	-1.638 (.631)***	-2.590 (1.614)	.201 (.070)***	.204 (.081)**
Democracy	.080 (.106)	.050 (.142)	-.009 (.011)	-.007 (.012)
Dummy Cold War	1.191 (.819)	2.210 (1.441)	-.222 (.064)***	-.206 (.101)**
Ethnolinguistic Frac	-.186 (.051)***	-.190 (.084)**	.015 (.005)***	.015 (.005)***
Ethnolinguistic Frac ²	.174 (.054)***	.165 (.073)**	-.012 (.005)**	-.013 (.005)***
PKO	-22.409 (1.134)***	-15.577 (4.146)***	.852 (.143)***	2.413 (.509)***
War duration	.135 (.090)	.233 (.128)*	-.020 (.007)***	-.020 (.010)**
Dummy if 2nd peace period	1.063 (.969)	2.497 (1.278)*	-.255 (.077)***	-.250 (.090)***
Obs	254	254	254	254
Log pseudolikelihood	-18.723	-8.069	-7.274	-7.782
AIC	60.446	40.138	38.548	39.564

Note: Significant at (*) 10%, at (**) 5%, at (***) 1%

For clarity concern, the following variables included in the regression are not reported: External balance ratio, dummy if the primary commodity exports ration was missing and replaced by the average for the country over the all period, log of the surface of the country, dummy for Sub Saharan Africa, time period dummies and constant term.

Table 3: The duration of peace

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>ODA/GDP</i> _{<i>t</i>-1}	0.116 (0.062)*	-0.048 (0.067)	0.116 (0.062)*	0.06 (0.081)	0.065 (0.111)	0.041 (0.119)	0.066 (0.08)
<i>ODA/GDP</i> ² _{<i>t</i>-1}	-0.012 (0.006)**	-0.014 (0.008)*	-0.012 (0.006)**	-0.006 (0.004)*	-0.004 (0.006)	-0.002 (0.007)	-0.007 (0.007)
Growth	0.022 (0.038)	0.038 (0.033)	0.022 (0.038)	-0.111 (0.049)**	-0.066 (0.047)	-0.063 (0.043)	0.029 (0.061)
Ln GDP per cap	0.17 (0.081)**	0.233 (0.088)***	0.17 (0.081)**	0.054 (0.082)	0.108 (0.095)	0.102 (0.079)	0.225 (0.177)
Ln inflation	-0.017 (0.029)	-0.037 (0.04)	-0.017 (0.029)	-0.198 (0.078)**	-0.129 (0.068)*	-0.133 (0.059)**	-0.108 (0.127)
Iry commodities exports/GDP	-0.249 (0.142)*	-0.260 (0.195)	-0.249 (0.142)*	-0.627 (0.276)**	-0.596 (0.197)***	-0.528 (0.18)***	-0.908 (0.52)*
Iry commodities exports/GDP ²	0.095 (0.065)	0.108 (0.074)	0.095 (0.065)	0.231 (0.126)*	0.233 (0.098)**	0.206 (0.086)**	0.545 (0.295)*
Democracy	-0.011 (0.014)	-0.013 (0.013)	-0.011 (0.014)	-0.031 (0.014)**	-0.026 (0.015)*	-0.026 (0.014)*	0.036 (0.016)**
Ethnolinguistic Frac	0.011 (0.006)*	0.011 (0.005)**	0.011 (0.006)*	0.02 (0.009)**	0.014 (0.01)	0.013 (0.011)	0.039 (0.02)**
Ethnolinguistic Frac ²	-0.009 (0.006)	-0.010 (0.006)	-0.009 (0.006)	-0.021 (0.008)***	-0.014 (0.008)*	-0.013 (0.01)	-0.040 (0.023)*
PKO	1.780 (0.606)***	1.752 (0.34)***	1.338 (0.7)*	2.464 (0.927)***	1.808 (0.84)**	2.012 (0.961)**	2.025 (0.878)**
War duration	-0.012 (0.011)	-0.007 (0.01)	-0.012 (0.011)	-0.006 (0.011)	-0.008 (0.012)	-0.008 (0.013)	-0.021 (0.016)
Dummy if 2nd peace period	-0.217 (0.132)	-0.193 (0.128)	-0.217 (0.132)	-0.067 (0.154)	-0.062 (0.122)	-0.105 (0.133)	-0.352 (0.327)
1st 2years of peace	-1.957 (0.239)***	-2.439 (0.207)***	-1.957 (0.239)***	-1.669 (0.273)***	-1.838 (0.368)***	-1.822 (0.365)***	-1.900 (0.255)***
2nd 2years of peace	-1.500 (0.214)***	-1.974 (0.158)***	-1.500 (0.214)***	-1.393 (0.248)***	-1.485 (0.349)***	-1.483 (0.318)***	-1.447 (0.243)***
3rd 2years of peace	-1.029 (0.19)***	-1.558 (0.138)***	-1.029 (0.19)***	-1.142 (0.322)***	-1.139 (0.423)***	-1.134 (0.394)***	-1.081 (0.188)***
4th 2years of peace	-0.710 (0.218)***	-1.297 (0.169)***	-0.710 (0.218)***	-0.600 (0.254)**	-0.709 (0.433)	-0.719 (0.367)*	-0.882 (0.227)***
1st 2years of peace x <i>ODA/GDP</i> _{<i>t</i>-1}		0.239 (0.058)***					
2nd 2years of peace x <i>ODA/GDP</i> _{<i>t</i>-1}		0.219 (0.053)***					
3rd 2years of peace x <i>ODA/GDP</i> _{<i>t</i>-1}		0.245 (0.047)***					
4th 2years of peace x <i>ODA/GDP</i> _{<i>t</i>-1}		0.311 (0.163)*					
<i>ODA/GDP</i> x PKO			0.263 (0.087)***				
Executive elections shift				-0.234 (0.093)**	-0.058 (0.072)		
Legislative elections shift				0.249 (0.103)**		0.019 (0.04)	
Remittances							-3.506 (6.064)
Cons	1.003 (0.714)	0.381 (0.723)	1.003 (0.714)	1.586 (0.297)***	1.923 (0.6)***	1.911 (0.488)***	1.130 (0.676)*
Obs	273	273	273	209	209	209	198
Log pseudolikelihood	-12.46	-2.904	-12.46	-1.401	-5.477	-5.729	-2.049

Note: Significant at (*) 10%, at (**) 5%, at (***) 1%

For clarity concern, the following variables included in the regression are not reported: external balance ratio, dummy if the primary commodity exports ration was missing and replaced by the average for the country over the all period, log of the surface of the country and dummy for Sub Saharan Africa.

Figure 2: **Graphic of the hazard ratios**

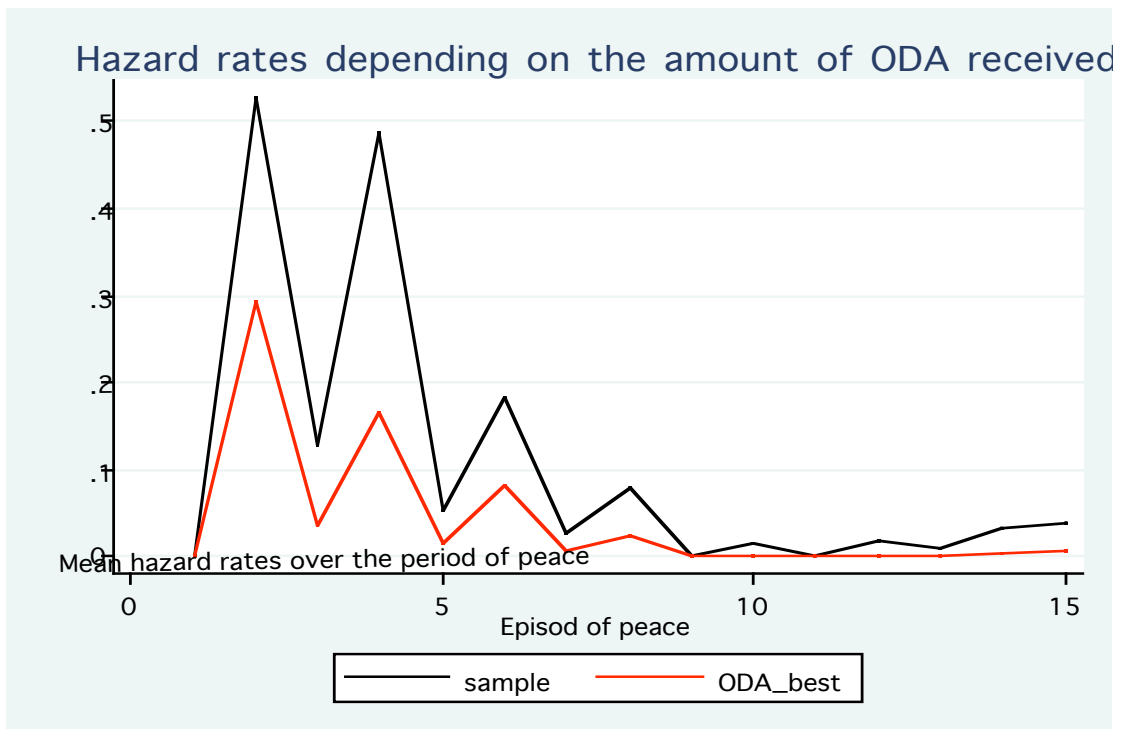


Table 4: The duration of peace: robustness tests

	(1)	(2)	(3)	(4)	(5)
<i>ODA/GDP</i> _{t-1}	0.227 (0.065)***	0.105 (0.065)	0.151 (0.067)**	0.072 (0.057)	0.12 (0.057)**
<i>ODA/GDP</i> ² _{t-1}	-0.020 (0.007)***	-0.011 (0.008)	-0.014 (0.006)**	-0.008 (0.006)	-0.013 (0.006)**
Growth	0.052 (0.033)	0.031 (0.029)	-0.026 (0.028)	0.046 (0.045)	0.017 (0.039)
Ln GDP per cap	0.267 (0.08)***	0.156 (0.082)*		0.184 (0.094)**	0.161 (0.082)**
<i>LnGDPpercap</i> _{t-1}			0.119 (0.092)		
Ln inflation	-0.031 (0.042)	-0.006 (0.042)	-0.052 (0.059)	0.002 (0.045)	-0.020 (0.029)
Iry commodities exports/GDP	-0.340 (0.188)*	-0.237 (0.153)	-0.236 (0.145)	-0.359 (0.189)*	-0.259 (0.145)*
Iry commodities exports/GDP ²	0.126 (0.088)	0.087 (0.057)	0.091 (0.054)*	0.133 (0.075)*	0.1 (0.063)
Dummy if missing	-0.040 (0.09)	-0.122 (0.099)	-0.093 (0.072)	-0.207 (0.123)*	-0.137 (0.099)
Democracy	-0.016 (0.01)	-0.005 (0.02)	-0.004 (0.019)	-0.015 (0.013)	
Polity					-0.005 (0.009)
Ethnolinguistic Frac	0.009 (0.005)*	0.006 (0.011)	0.012 (0.007)*	0.01 (0.007)	0.012 (0.007)*
Ethnolinguistic Frac ²	-0.009 (0.006)	-0.003 (0.014)	-0.010 (0.007)	-0.008 (0.007)	-0.010 (0.006)*
PKO	0.683 (0.171)***	2.761 (0.863)***	2.160 (0.673)***	1.480 (0.302)***	2.648 (0.869)***
War duration	-0.002 (0.007)	-0.016 (0.014)	-0.009 (0.012)	-0.014 (0.009)*	-0.012 (0.012)
Dummy if previous war	-0.147 (0.085)*	-0.233 (0.148)	-0.256 (0.168)	-0.216 (0.11)**	-0.224 (0.143)
Proba Heckman		5.903 (11.091)			
Cons	0.346 (0.68)	1.260 (0.714)*	1.317 (0.878)	1.297 (0.658)**	1.008 (0.689)
Obs	203	265	265	266	273
Log pseudolikelihood	-1.855	-12.466	-13.058	-12.704	-12.649
X ²	.	3417.366	2330.899	2305.774	2720.352

Note: Significant at (*) 10%, at (**) 5%, at (***) 1%

For clarity concern, the following variables included in the regression are not reported: External balance ratio, dummy if the primary commodity exports ration was missing and replaced by the average for the country over the all period, log of the surface of the country, dummy for Sub Saharan Africa and time period dummies.

Table 5: **Probability of entering the dataset**

	PRIO peace onset
Ethno linguistic Fractionalization	0.047 (2.47)**
Ethno linguistic Fractionalization ²	-0.055 (2.25)**
Real GDP per capita	-0.000 (0.51)
Sub-Saharan Africa	0.465 (0.85)
Population size	-0.000 (1.06)
Surface	0.000 (0.81)
Dummy 80s	1.186 (2.38)**
Dummy 90s	1.185 (2.35)**
Constant	-5.466 (7.83)***
Observations	3308
Pseudo R ²	0.1426

Note: Significant at (*) 10%, at (**) 5%, at (***) 1%

Table 6: Instrumenting Aid

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
UKvoting									
USvoting									
FRvoting									
JPNvoting									
UKlang									
USlang									
FRlang	-0.0001 (0.00006)					-0.0001 (0.00006)**	-0.0003 (0.00006)***		-0.0001 (0.00006)*
UKrel	0.0005 (0.0001)***	0.0005 (0.0002)***	0.0005 (0.0002)***	0.0004 (0.0002)***	0.0008 (0.0002)***			0.0005 (0.0001)***	0.0005 (0.0001)***
USrel									
FRrel									
JPNrel									
GRMrel	0.0002 (0.00004)***				0.0002 (0.00005)***	0.0001 (0.00004)**		0.0002 (0.00005)***	0.0002 (0.00004)***
UKdist					1.198 (0.423)***				
USdist									
FRdist							1.123 (0.216)***		
JPNdist									
GRMdist									
Cons	16.153 (8.633)*	-5.472 (8.329)	-5.669 (8.253)	-5.606 (8.274)	-1.185 (10.300)	8.281 (9.206)	-13.013 (9.061)	11.948 (7.483)	16.502 (8.518)*
Obs	276	232	232	232	223	267	272	270	276
R ²	0.77	0.795	0.795	0.794	0.83	0.773	0.783	0.765	0.773

Note: Significant at (*) 10%, at (**) 5%, at (***) 1%

Only the instrumental variables are reported in the table.

Column (1) corresponds to the instrumentation of the regression of reference (Table 4- (1)); Column (2), (3) and (4) refers to the regression with the election shift variables (respectively with both, the executive elections only and the legislative elections only). Column (5) corresponds to the regressions with the remittances; Column (6) refers to the selection bias regression and column (7) to the replacement by the lag value of the GDP per cap. Column (8) corresponds to the regression where India and China are removed and finally column (9) to the one with an alternative democracy variable.

Table 7: Instrumenting Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Landlocked dummy	-345 (1.122)	-1.856 (1.620)	-1.801 (1.608)	-1.780 (1.612)	1.580 (1.297)	-574 (1.145)	-1.876 (1.019)*	-467 (1.173)	-247 (1.118)
Ln distance to markets	6.855 (2.402)***	6.162 (2.478)**	6.278 (2.502)**	6.150 (2.490)**	11.728 (3.553)***	7.697 (2.398)***	6.853 (3.564)*	8.501 (2.286)***	6.794 (2.406)***
Cons	-59.398 (26.130)**	-41.654 (26.952)	-43.636 (27.060)	-42.196 (26.971)	-103.348 (35.249)***	-68.048 (25.217)***	-52.185 (35.726)	-77.223 (24.997)***	-58.832 (26.278)**
Obs	304	238	238	238	229	295	295	297	304
R ²	0.236	0.252	0.247	0.249	0.228	0.238	0.265	0.211	0.233

Note: Significant at (*) 10%, at (**) 5%, at (***) 1%

Only the instrumental variables are reported in the table.

Column (1) corresponds to the instrumentation of the regression of reference (Table 4- (1)); Column (2), (3) and (4) refers to the regression with the election shift variables (respectively with both, the executive elections only and the legislative elections only). Column (5) corresponds to the regressions with the remittances; Column (6) refers to the selection bias regression and column (7) to the replacement by the lag value of the GDP per cap. Column (8) corresponds to the regression where India and China are removed and finally column (9) to the one with an alternative democracy variable.

Table 8: Duration of peace: Amelia

	(1)	(2)	(3)	(4)	(5)
ODA/GDP_{t-1}	0.03 (0.023)	0.119 (0.152)	0.19 (0.306)	0.118 (0.14)	0.114 (0.14)
ODA/GDP_{t-1}^2	-.001 (0.001)	-.012 (0.016)	-.010 (0.013)	-.010 (0.017)	-.011 (0.014)
Growth	0.009 (0.006)	0.016 (0.03)	0.015 (0.029)	0.015 (0.028)	0.023 (0.034)
Ln GDP per cap	0.066 (0.051)	0.164 (0.152)	0.165 (0.153)	0.173 (0.136)	0.156 (0.146)
Ln inflation	-.032 (0.03)	-.007 (0.076)	-.014 (0.097)	-.012 (0.073)	0.002 (0.08)
Iry commodities exports/GDP	0.006 (0.008)	0.01 (0.025)	0.009 (0.022)	0.01 (0.024)	0.01 (0.025)
Iry commodities exports/GDP ²	-.0001 (0.0003)	-.0002 (0.0005)	-.0002 (0.0004)	-.0002 (0.0005)	-.0002 (0.0005)
Democracy	-.003 (0.009)	-.008 (0.022)	-.009 (0.022)	-.008 (0.021)	-.005 (0.022)
Ethnolinguistic Frac	0.002 (0.004)	0.002 (0.005)	0.003 (0.005)	0.003 (0.004)	0.003 (0.005)
Ethnolinguistic Frac ²	4.03e-06 (0.00004)	1.00e-05 (0.00005)	3.86e-06 (0.00005)	4.02e-06 (0.00004)	1.00e-05 (0.00005)
PKO	0.15 (0.112)	0.263 (0.418)	0.275 (0.35)	0.423 (0.635)	0.268 (0.423)
ODA/GDP x PKO				-.036 (0.109)	
War duration	-.009 (0.006)	-.011 (0.014)	-.013 (0.014)	-.012 (0.013)	-.012 (0.014)
Dummy if 2nd peace period	-.151 (0.073)**	-.144 (0.145)	-.152 (0.143)	-.142 (0.144)	-.147 (0.144)
1st 2years of peace	-1.867 (0.111)***	-1.894 (0.22)***	-1.750 (0.483)***	-1.895 (0.227)***	-1.889 (0.225)***
2nd 2years of peace	-1.325 (0.086)***	-1.403 (0.185)***	-1.268 (0.403)***	-1.401 (0.19)***	-1.397 (0.187)***
3rd 2years of peace	-.796 (0.107)***	-.833 (0.223)***	-.785 (0.409)*	-.833 (0.223)***	-.826 (0.224)***
4th 2years of peace	-.440 (0.119)***	-.502 (0.215)**	-.311 (0.629)	-.499 (0.214)**	-.495 (0.217)**
1st 2years of peace x ODA/GDP_{t-1}			-.095 (0.258)		
2nd 2years of peace x ODA/GDP_{t-1}			-.091 (0.245)		
3rd 2years of peace x ODA/GDP_{t-1}			-.048 (0.253)		
4th 2years of peace x ODA/GDP_{t-1}			-.110 (0.29)		
Remittances					-1.86e-11 (2.50e-11)
Cons	2.487 (0.638)***	1.603 (1.835)	1.467 (2.170)	1.461 (1.630)	1.664 (1.795)
Obs	741	417	417	417	417
Log pseudolikelihood	-66.323	-40.487	-38.617	-40.038	-40.028

Note: Significant at (*) 10%, at (**) 5%, at (***) 1%

In column (1) the ODA ratio and the growth rate are not instrumented. They are however in all the subsequent regressions.

5 multi imputed dataset have been created using Amelia II, the results have been computed in Stata using mitools.

For clarity concern, the following variables included in the regression are not reported: External balance ratio, dummy if the primary commodity exports ration was missing and replaced by the average for the country over the all period, log of the surface of the country and dummy for Sub Saharan Africa