ERASMUS UNIVERSITY ROTTERDAM

CIVIL CONFLICTS AND ECONOMIC CONSEQUENCES

MASTER THESIS
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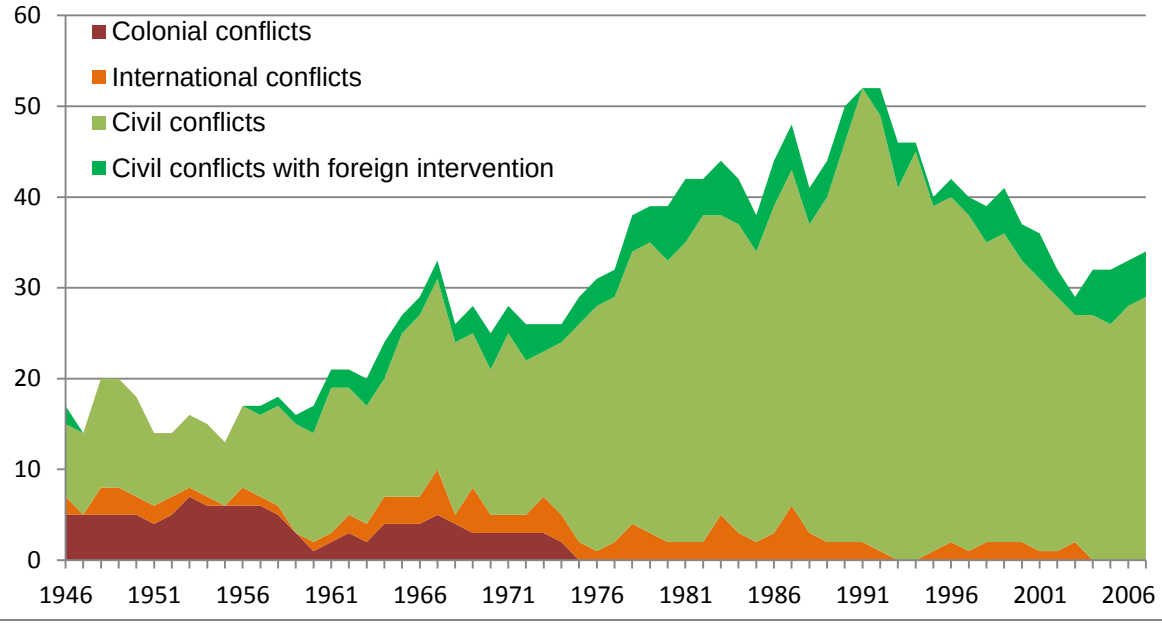
I - Introduction

Wars have always been present. And they are often devastating. People are killed, buildings are destroyed. But wars leave their mark in different ways. Political systems can be disrupted. Whole generations can miss education. Capital is destroyed or moved abroad. Roads and bridges are destroyed, affecting the infrastructure. Foreign investments and stock markets collapse. All these consequences are likely to impact the future economic growth of a country. The focus of this thesis will be on the economic consequences of conflicts.

During the last decades there has been a shift in the field of armed conflict. Since the Second World War the amount of 'large wars' steadily declined. The end of the Second World War marked the beginning of a new period: global participation in order to prevent conflicts. As a consequence, major wars involving multiple countries or even continents became rarer. This 'conscience' aiming that conflicts should be prevented resulted in a more global role for the United Nations and the NATO. These organizations aim for peacekeeping on a global level.

And partly they succeeded. Conflicts involving multiple countries remained stable or declined (as can be seen in figure 1 below). However, the number of civil conflicts vastly increased during the last seventy years. These wars often hit only one country. They even do not necessarily need to influence the whole territory, but can be more area-related. Examples of country-wide civil wars are the Rwandan civil war (1990-94) or the Kosovo war (1998-99). An example of a more area-specific war is

Figure 1: Number of conflicts per year



the Sudanese conflict (2011-present) which is fought in the southern states, hitting only 20% of the Sudanese soil directly. This even led to the birth of a new state, the Republic of South Sudan, still the youngest state in the world. Currently the Syrian civil war or the Nigerian/Cameroonian conflicts with Boko Haram are almost daily in the news. This demonstrates the pertinence at this moment.

In this thesis I will investigate the economic consequences of these so-called civil conflicts. In particular the focus will be on the growth of the gross domestic product, in short GDP, in the years after the conflict has ended. Both the GDP growth level and the absolute level will be used. For these the pre-war period will be compared with the post-war period to examine possible differences in conflict countries. Previous research focused more on the pre-war (economic) situation of a country. Though I focus on the post-war consequences, these two are linked and can become a circle. Imagine a country that is facing a civil war and assume this leads to economic consequences in the post-war period. If the economy performs worse after the conflict (previous research showed a relation between economic situations and the possibility of a conflict, see next section), this can not only be the post-war period but can become a pre-war period for a new conflict. This demonstrates the relevance of my research.

This research extends the current research in three ways. First, the dataset will be updated with roughly the last decade, leading to a 30% longer timeframe compared to other research. Second, I will check the robustness of earlier results by the use of various amounts of years after (and before) the conflict and by using additional robustness checks. By doing this, the robustness of the relations, but also the relevant methodology, will be examined. Third, I will use an additional threshold which includes less intense and deathly conflicts. This is important; in the current literature the conflicts with more than 1000 battle deaths a year are extensively investigated. The conflicts with less battle deaths often remain unexamined. In this way a conflict, which lasted years but never exceeded the 1000 battle deaths a year threshold will be ignored by other research. Examples of such conflicts are the Spanish conflict between the government and the Basque ETA movement, the conflict in Northern Ireland with the IRA and the Surinam Guerilla War. Another recent tragic example of a conflict that would have qualified for the low threshold, but not the high, was the terrorist attack in Sousse, Tunisia. This conflict is likely to be of major impact on the tourist industry and therefore the economy. The question in this thesis will be if the relationships and conclusions change when these smaller conflicts are also taken into account. Including these smaller conflicts might lead to a different story and this research intends to find out.

The next section will deal with the theory of economic consequences of civil conflicts and the corresponding empirical research. In section III the data will be presented. Section IV will show the

results for the GDP data. In order to provide some extra information on both the methodology and the components of economic growth, a number of additional variables will be investigated in section V. Section VI will conclude on the main findings and possible shortcomings.

II - Theory & existing research

2.1 Theory

There are two major theories concerning the impact of civil war on the economy. The first one finds it origin in the seventies of the last century and was first suggested by Benoit (1973 & 1978). Benoit argued that civil war (or a conflict in general) in developing countries can boost the economy through military expenditures. The theory behind this is that military expenditures can boost a small, weak economy through different channels. Benoit mentions a list of possible mechanisms, the first being that the training and education of military personnel has some spillover effects in the private sector. Examples can be that when soldiers are trained well in the field of aviation, they can contribute to the private sector through working in commercial aviation after the war. Second, he argues that military infrastructure can be used by civilians. Examples can be bridges or railways, but also more abstract things like weather information or research and development. Third, military use provides security more efficient than the private sector would provide this, making a larger share of the GDP available for other goods and services. Fourth, and probably the most reasonable one, is that military expenditure creates more aggregate demand and boosts the economy. This is similar to what Keynes called an 'expansionary policy', in which the government aims to boost the economy through more public expenditures. Fifth, Benoit states that military expenditures in development countries might even attract foreign aid. An example can be the United Nations providing aid to a country in civil war to 'maintain order', as this is currently happening in Iraq and Syria. The negative effects that military expenditures would have on GDP might then be (partly) offset by the positive effect these expenditures simultaneously have on foreign aid. Finally, more military expenditures lead to a more secure state. Safety and security are one of the factors that are positively related with economic growth, possibly through by example property rights.

The second theory takes a completely different view and argues that civil conflicts lead to a lower economic growth (World Bank, 2003). On a more general level it leads to destruction and less investments. This can theoretically be linked to the classical theory. Adam Smith (1776) argued that income can be generated from three sources, namely land, labor and capital. A civil war is likely to influence all three. Land is likely to be damaged and crops can be destroyed. Though this is not likely to cause major damage to a countries economy by itself, the other two are likely to significantly impact a decline in GDP growth. Through the destroyed capital (and infrastructure), people become less productive and productivity will decline, making labor less rewarding. But in a broader aspect, civil war will simply lead to casualties and reduce the labor population. From the remaining population a part will no longer work but take part in the civil conflict, so less people will actually

work. The part that will not work might even be busy destroying or sabotaging the country. For capital this will work mainly through two different channels. The most intuitive one is that civil conflict will destroy capital (bridges, roads, factories and buildings). Less capital will lead to less income from capital, and hence lowers the GDP growth accordingly. Secondly, some of the capital will be moved to safer areas. Though this can be a safer region of a country when we are talking about regional civil wars, capital can also be transferred abroad when the entire territory will be vulnerable. Capital transferred abroad will of course not contribute to GDP growth on a domestic level. Finally, not only domestic capital is affected, but foreign investments will decrease when a country experiences war.

2.2 Earlier empirical research

2.2.1 The 'Benoit-hypothesis': military expenditures and growth

As one can clearly see, the two theories are opposite. There has been much research in the field of both, with mixed results. It all started with the findings of Benoit (1973). Benoit analyzed 44 developing countries for the period 1950-65 and showed, through estimating correlations, that countries that possessed large military spending also experienced high economic growth rates. He instantly addressed the possible existence of a causality issue which could mean that countries with high economic growth rates had more money available and therefore had more military spending. This could further be accelerated to a higher tax rate for growing economies, leading to higher tax revenues. Further research (Benoit, 1978) led to results that did not support this hypothesis. He found no relation between other macro-economic variables and military spending, by example between the tax rate and military expenditures. His main theory remained that military spending could enhance economic growth.

According to the World Bank (2003), developing countries in civil war raise their military expenditures as a part of GDP from 2.8 percent during peacetime to 5 percent during conflict. Those resources are then used for the military instead of more efficient choices and the additional military budget will even cause additional damage. We can thus assume that higher military expenditures are a characteristic of civil war. Since this makes the relationship between military expenditures and economic growth more interesting, we will take a closer look at the corresponding literature.

The conclusion by Benoit (1973), that became famous as the 'Benoit hypothesis', has since then been subject of extensive research. Kaldor (1976) finds a negative correlation for 40 development countries during the period 1963-73, which contradicts the statement by Benoit. Kennedy (1974) finds that coefficients can differ per continent, as he finds a correlation of 0.28 for Asia but -0.42 for Latin America. Another important finding was reported by Frederiksen and Looney (1983). They

divided the countries Benoit used into two different groups, where one category had an abundance of resources and the other a constraint on resources. They found that the resource-abundant countries had a positive correlation coefficient (0.22) but the resource-constrained countries had a negative (-1.22). They concluded that when countries are constrained on resources, military expenditures negatively impact growth since the already constrained resources are directed to the military industry where it might be better used by more productive industries. Faini et al (1984) state that though military expenditures can enhance growth through some channels, it slows down the growth through others making the total effect negative.

The main criticism on Benoit's hypothesis came from an article from Grobar and Porter (1989). They state that the work of Benoit had been reassessed multiple times, but there has not been a definite conclusion yet. The general finding is that the results presented by Benoit are unusual and positive correlations are seldom reproduced. But they also argue that the negative correlation, which might be expected, is not often found as well. They argue the analysis of Benoit (1973) had several problems. First, Benoit also reasons that it might have a negative impact and that only correlations are reported that support the opposing view. Grobar and Porter argue that the model by Benoit indicates that a one percentage rise in military expenditures reduces growth of non-military expenditures by a quarter percent. This indicates that Benoit's article can also be used to argue *against* higher military expenditures. Second, Benoit does argue that there are positive relations between the expenditures and growth, but he does not support this with evidence. Finally, he only reports correlations and these are positive, but these say nothing about the causality. Mohammed (1993) addresses the possible causality problem Benoit (1973) and Grobar and Porter (1989) pointed out. Using causality test, he finds no unidirectional relationship between military spending and growth. He states that when investigating the relationship between military expenditures on growth the former should be treated as an exogenous variable.

Grobar and Porter (1989) further state, based on Benoit (1973), that it does not matter whether you take GNP or GDP, aggregate or per capita, since they all move together. They do however state that it is important to choose the correct measure for the military expenditures. They theoretically show that using multiple definitions of military expenditures can lead to different answers. Where Benoit used percentage of defense expenditures of GDP, Grobar and Porter argue that by using this method, foreign military aid is omitted. Foreign military equipment that is transferred to a country is ignored. Furthermore, it is not the total percentage of GDP that matters, but the *real* military presence. They (theoretically) show that the spillover effects of the military to civilian sectors are sometimes rejected or accepted, depending on the way expenditures are measured. On the correlation part, they argue that the results by Benoit are not robust to different countries and different time periods,

though they are significant for the dataset used by Benoit. Removing two of the most significant observations (Taiwan and Jordan) lead to a drop of nearly fifty percent in the correlation coefficient. They state that it is likely that the result found by Benoit (1973) is largely depending on these two extreme observations. More importantly, Grobar and Porter (1989) state that when adding additional resources, investment or when controlled for per capita GNP, the positive significant relationship between military expenditures and GDP disappears and becomes insignificant, though it is still not negative. Concluding, they state the results of Benoit (1973, 1978) are seldom reproduced and often negative or insignificant correlations are found. They conclude that Benoit's results are not robust, though the positive relationship still cannot be ruled out completely.

After the article by Grobar and Porter research focused more on the possible negative relationship between expenditures and GDP growth. Knight et al (1996) find that cuts in military spending lead to higher economic growth in the future. They argue this is a result of less capital accumulation when the military spending is higher. More is then 'wasted' on the unproductive sector. This is an important finding, since it demonstrates that the theory about military expenditures and higher demand is not valid according to the dataset used by Knight, which contained 124 countries. Besides the accumulation argument, they also propose the *Peace Dividend*. According to Knight et al, a more secure environment, which goes hand in hand with military expenditure cuts, will lead to a Peace Dividend provided the cuts are sustained. This implies that when military expenditures are low and stability in the region is high, hence no (civil) conflicts, there is an additional boost to the economy. This contradicts the theory of military expenditures and larger demand. Dreze (2006) states that there is sufficient evidence that higher military expenditures slow down the economy. This does not mean that lowering these expenditures is enough, as Dreze argues that there is no convincing evidence that a drop in expenditures benefits the economy. Another interesting finding is that the military expenditures do not fall back to the pre-conflict level after the conflict has ended (World Bank, 2003).

Dunne (2010) investigates the relationship between military expenditures and GDP growth for Sub-Saharan African countries. Dunne specifically focusses on the post-Cold War period, using fixed effects panel data. Dunne finds that for the whole dataset military expenditures have a negative impact on domestic growth levels. He also splits the dataset in two groups, countries involved in conflicts and countries that are not involved in conflicts. Conflict countries then exhibit a long-term impact of military expenditures on growth, where non-conflict countries only possess a short-term effect. Dunne argues this can be explained by the fact that countries in conflict possess a 'war economy', which acts differently than an economy during peace.

Ganegodage and Rambaldi (2013) perform a country-analysis on the Sri-Lankan civil war, which lasted over 30 years. They find that for Sri Lanka, which does not possess an arms producing industry, there are no positive effects of higher military spending. In contrast, they find a negative annual GDP effect of 9% caused by the war. Second, they also find a high return on capital which could be caused by the destruction of capital during the war or investments. They do not analyze this further. Finally, they conclude that now the conflict has ended, a proper institutional framework must be constructed to get the economy in a rapid development.

2.2.2 The 'Destruction hypothesis'

Though the first theory originally described by Benoit (1973) is sometimes and under certain circumstances found, it is clearly more often disproved. The results tend to point to a negative relationship between military expenditures and income growth. The mechanism, through which this occurs, by demand side, is however different than the reasoning of the second theory implies.

The second theory focused on the destruction of resources and factors of production and the period after the conflict. Capital is destroyed or moved abroad; the labor force is killed or fled to neighboring countries. Collier (1999) was one of the first to thoroughly examine the relation between conflicts and the period after the conflict. He argued that civil wars are more destructive than 'normal' wars, by example, because they are fought on domestic soil alone. Collier examined how destructive these wars can be in terms of GDP growth in the years following a war. He used decade average GDP growth and constructed three variables that measured the length and the post-war period in that decade. By using these decade-averaged variables, some heterogeneity is lost. Collier showed that one year of civil war causes the annual GDP growth rate per capita to drop by 2.2%. He further argued that a 15-year war could lower the GDP growth rate by about 30%, though this is calculated through extrapolation. Collier then focusses on the post-war period and finds that the period following a one year civil war experiences a lower GDP growth due to the conflict. According to Collier, a one year war will lead to a 2.2% decline in GDP growth in the five years following the conflict. By contrast, Collier finds that the longer a war lasts, the smaller the decline in growth will become. Ultimately, a long war can even lead to a positive GDP growth. Collier states that a 15-year war could lead to a 5.9% *positive* growth per annum, which is very different from the 30% growth decline that war would generate *during* the conflict. This is likely to be the result of the so called *catch-up growth*. Much is destroyed during the conflict and after the war there is more to rebuild. Hence, the 'base' is lower and you can rebuild more, leading to very high growth rates since a country has to catch up and rebuild what is lost.

The link between conflict destruction and growth is also examined by Gyimah-Brempong and Corley (2005). They investigate Sub-Saharan African countries for the period of 1960-1996. They use both instrumental variables and panel data. They investigate the relationship between the incidence of civil war and the effect on post-war GDP growth rates. They especially control for the incidence of civil war using instrumental variables, solving the possible endogeneity issue. They argue that the factors that influence the start of a conflict are also determinants of income growth. Therefore they instrument with the one period lead of the predicted onset of a conflict. In this way a new variable with its own distribution is constructed which is no longer correlated with the error term. They find that regressions with the endogeneity issue are likely to result in a downward bias. This means that the actual decline in growth might be larger than the regression suggest. When controlled for the endogeneity problem, they fail to obtain a significant effect of the incidence of civil war on GDP growth. In addition, they address the heterogeneity issue of civil wars by taking the severity of conflicts into account. They construct dummy variables for their datasets. Though their variables are incapable of giving a precise result due to a lack of unit measurement, they all point to more negative results when the severity is higher. For one dataset the negative effect even increases with an increasing rate when the severity gets higher. They conclude with two major findings; a negative effect of the incidence of civil war on growth levels (as long as controlled for the endogeneity) and a negative effect of more severe civil wars on economic growth.

Another interesting study on the effect of conflict on GDP is a study by Murdoch and Sandler (2002). They investigate the relationship between conflicts and negative spillover effects to neighboring countries. They find a significant negative effect: a one month civil war leads to a GDP decline of 0.4% in neighboring countries. They state this is due to uncertainty and disrupted economic activities.

Chen, Loayza and Reynal-Querol (2008) also analyze the consequences of war using an event-based methodology. In this way, they compare the pre- and post-war situation of a country by itself. In addition, they compare the civil conflict countries with two control groups. They specifically focus on the recovery of a country following the end of a conflict and try to take the heterogeneity of conflicts into account, though they only focus on length. They find that almost all aspects of a society catch up in some way, but their most interesting finding is a per capita income surge of 2.4 percent above pre-war levels for countries suffering from a conflict. Chen et al link this to the high potential for recovery which is the result of the destruction during wartime. Finally, they find that longer conflicts lower *per year* GDP per capita *during* the conflict, but the longer a conflict lasts the lower the catch-up rate is after the war. Hence, longer conflicts lead to lower GDP per capita during the war and a slower acceleration of GDP following the war, and are therefore more destructive through two different mechanisms.

The World Bank (2003) states that the most important economic loss of civil conflicts is not due to the first (the diverting of resources) but due to the second consequence, namely the destruction of capital and infrastructure. An example is the country of Mozambique, where according to the research by Bruck (2001) over 40 percent of the country's solid capital was destroyed. In Liberia similar damages to the transportation network occurred. According to Canning (1998) infrastructure is one of the main determinants of economic growth, so this demonstrates one of the possible channels though which civil war affects economic growth. The World Bank (2003) stated that a typical country before the start of a civil conflict had about 9% of their assets abroad. After a conflict, this grows to about 20%, resulting in a smaller growth of GDP through less available capital.

Most of the previous research fails to capture one thing: the heterogeneity of conflict. Conflicts are examined through dummy variables or by the length of the conflict (Collier, 1999). One study that does try to capture this is a study by Weinstein and Imai (2000). They also find empirical evidence for a decline in GDP growth as a result of civil wars. They try to capture the diversity of conflicts by extending the research by Collier (1999) through examining the spread of civil war. For this they construct a new variable that takes a value from 1 till 5, depending on the geographical spread of the civil conflict. They conclude that a more widespread civil war can lead to five times more 'damage' than small regional conflicts, where by example only one province is affected.

2.2.3 Externalities

Keefer (2008) investigates the relationship between political credibility and the effect of civil war. Though this deals with the causes of civil war and not the consequences, Keefer does show some interesting findings. Keefer's hypothesis is that political leaders who are incredible no longer aim to address the majority, since the majority is not likely to believe them. Instead, these leaders will undertake policies that benefit the minority groups that do support him. Finally Keefer argues that this will lead to an underprovision of public goods and an overprovision of private goods. He finds broad support for his hypothesis. Concerning civil wars, this finding is interesting since it implies that civil wars are likely to end political incapable regimes. Following the end of a civil war, when foreign aid is present and peacekeeping is pursued; a new and capable regime can lead to a higher growth due to a better balance between public and private goods. According to Keefer civil war can lead to more economic growth if peacekeeping is sustained and capable regimes and institutions are founded. This is clearly a different channel than the expansionary policy, but it demonstrates a positive effect cannot be ruled out completely and is not only found by Benoit (1973).

Chen et al (2008) also mention some positive effects can occur after a conflict. They state that a country might actually benefit from conflict trough better education and healthcare (by example

infant mortality rates), possible through the global public goods available as a form of aid after conflict. A report by UNESCO (2010) shows that since 2000 there has been a lot of development in providing education to conflict and third world countries. This all started with the Dakar goals (made in 2000). Many countries successfully tried to meet these goals in the following years, but there are countries that are far from reaching these goals. An interesting finding is that conflicts can be a threat but also an opportunity to education (Buckland, 2005) since a post-war conflict situation is often one that is ready for change. UNESCO (2010) examines 25 countries individually and finds a significant negative effect of conflict on education. In particular the effect is negative on the part of the population with formal education, the literacy rate and the number of years of education attained. These effects are found during the time of the conflict. For six countries no effects during the conflict are found.

A further analysis on the consequences on health is performed by Ghobarah, Huth and Russett (2003). They investigate the effect of civil conflicts on the number of casualties. An interesting thing in their research is that their aim is not on the direct casualties (people killed during the war, b.e. in combat) but more on the indirect deaths. This can by example work through health systems being disrupted, but also through higher crime levels after the conflict or refugees not having access to clean water. They find that civil wars lead to strong significant effects on diseases in the years following the conflict. They find weaker evidence that civil conflicts lead to more deaths through a disrupted social order, by example through murder and accidents.

Trying to quantify the effect, Lai and Thyne (2007) found a decline of enrollment between 1.6 and 3.2 percent during a conflict. Another study trying to investigate the effect focusses on the bombing of German cities during the Second World War (Akbulut-Yuksel, 2009) and shows the average years of education attended is lowered by 0.4 to 1.2 years, depending on the relative intensity of the bombing. Akresh et al (2008) study the effect of the Rwandan civil war and find a negative effect of over 18%. A similar negative effect is found for Cambodia with a drop of nearly ten percent (Merrouche, 2006).

These all seem to point to a negative impact of conflict on education. However, there are countries were conflict did not seem to have a significant impact on education in the long run. This is the case in the study of Miguel et al (2006). They study the effect of bombing during the war on education as a result of the Vietnam conflict. They do not find a lasting negative impact. Miguel et al argue this is a result of the foreign aid during and after the conflict.

2.3.4 Hypotheses

The literature review leads to a number of interesting findings. The first theory based on Benoit (1973), following from the positive correlations between expenditures and growth is not often reproduced. Most of the empirical research on Benoit's hypothesis results in a negative impact of conflict on the economy. The second theory is broader, dealing with civil conflicts and their economic consequences, but expecting a negative impact of conflict on GDP growth as well. Other research (Collier (1999)) found that conflicts can actually enhance growth, though this is likely to be so-called 'catch-up' growth. This leads to the first, general hypothesis.

Hypothesis 1: *Civil war has a positive impact on the GDP growth after the war, but this is likely to be the result of a lower post-war absolute per capita GDP.*

This hypothesis states that when the GDP growth is higher, this is likely to be the result of the 'catch-up' growth mechanism. When much is destroyed, the growth is higher after the conflict. As a result the GDP growth level will be higher than before the war, but the absolute GDP level should be lower.

As mentioned before, previous research often refused to take the duration and other aspects of conflict into account. I will extend the current research by trying to take the heterogeneity into account. One variable that captured the heterogeneity was the length of the conflict (Collier, 1999). Collier found that longer civil conflicts can affect the economy harder, but that the growth can even be higher. I will check if this also holds for a different and updated dataset. This leads to the second hypothesis.

Hypothesis 2: *Conflict duration has a positive impact on the post-war economic growth level.*

So, the longer a war will last, the more destructive such a war can be, ceteris paribus. But civil wars differ not only through length. Conflicts can also differ in the intensity. Think of a more intense conflict as one that has more casualties, more destroyed infrastructure or more combat situations. An example of a war that is relatively less intense is the conflict in Northern-Ireland. In general we can expect that two conflicts that only differ in intensity are likely to result in the more intense conflict to cause more economic damage. More economic damage will then, in according with the previous hypotheses, lead to a drop in absolute GPD and possibly a drop in GDP growth as well. Hence,

Hypothesis 3: *More intense conflicts damage the economy more.*

This third hypothesis will be checked through a variable that classifies a conflict as having more than 25 casualties a year or more than 1000. This will be further explained in the next section. Imai and

Weinstein (2000) did try to capture part of this heterogeneity, by estimating the spread of the conflict. They constructed a variable for the spread by collecting data on how much of a countries territory was affected by the civil conflict. Though this is likely to be related to intensity, the two are not similar and their research will be extended on this level.

III - Data & methodology

3.1 Introduction

In this section the data and methodology will be described. The first thing that needs to be determined is the list of civil conflicts. As mentioned earlier, I intend to follow the approach (and equations) by Chen et al (2008). In order to elaborate more on this approach, it will be explained first.

Chen et al (2008) investigated the effect of civil conflict by creating a pre- and post-war period. Each conflict was measured t=0. They gathered data for the seven years before the conflict and seven years after the conflict (which were coded as t-7 till t-1, and t1 till t7). They constructed their list of civil conflicts according to a few restrictions required for this approach. Because of data availability, conflicts needed to start in 1967 or later. Conflicts had to end in 1996 at latest, because of the use of data for the post-war period. When a country experienced two civil conflicts, there had to be a period of 10 years between the conflicts in which there was peace. If the period was less than ten years, the conflicts were merged into one conflict.

My starting point will be the methodology used by Chen et al, but will be adapted. I intend to not only check for the seven years before and after the conflict, but also for five and nine, to check the robustness of the results. In my opinion, it is likely that extending or shortening the period might change the results since the cut-off is arbitrary. As in accordance with Chen et al, a peace period between conflicts is required in order for two conflicts to be treated as separate ones. Since I extend the period under examination from 7 till 9 years, I also extend the peace period by two years, being 12 instead of 10 years.

I will also investigate the robustness of the results in a different way. Chen et al only used civil conflicts classified as having more than 1000 deaths per year. I will check the results for two databases, one with a threshold of 25 battle deaths a year and one with 1000 battle deaths a year. Using a lower threshold will lead to more civil wars that can be examined. An example is the conflict between the United Kingdom and the Irish Republican Army (IRA) fought in Northern-Ireland. This conflict lasted for nearly twenty-four years, but never exceeded the 1000-deaths-per-year threshold. By lowering the threshold, such smaller conflicts qualify for further analysis. It will be interesting to investigate if smaller conflicts affect the results.

Using a different threshold is not only likely to obtain more or less conflicts; it can also mean conflicts can have different lengths. A war that qualifies for the 1000-deaths threshold in the years 1985-1989 has five years of conflict, resulting in t-1 being 1984 and t+1 being 1990. But the end of the eighties

might have only been the more intense period of the war, and may have been surrounded by years with only a hundred deaths a year. By lowering the threshold, this same conflict might last from 1981 till 1992, leading to a totally different period under review (with t-1 and t+1 being 1980 and 1993 instead).

A third difference can be the merging of conflicts. Two 1000-deaths conflicts being 15 years apart will be treated as two different conflicts using the highest threshold. But if these wars only experience a five year gap when the threshold is lowered to 25, this will be treated as one single civil war. It will be obvious that the years under consideration are different. This last argument is more theoretically, since only a few conflicts are merged in the first place.

The previous arguments lead to my last two hypotheses. The fourth hypothesis deals with the timeframe used to investigate the effect of civil conflict on a countries economy. Hence,

Hypothesis 4: *Shortening or extending the pre/post war period does not change the results regarding the effect of civil war on the variables.*

This can be seen as a robustness check on the results obtained by Chen et al, and will be investigated for the economic and additional variables. It might provide interesting insights on the methodology used. The fifth and final hypothesis concerns the lowering of the threshold.

Hypothesis 5: *Lowering the threshold to 25 deaths/year does not change the results regarding the effect of civil war on the variables.*

It is somewhat similar to the third hypothesis; the difference is the first three are related to a clearly defined economic relationship we are looking for. The last two hypotheses are dealing with the overall set of variables, including the non-economic, and can refer to any relationship being different when the lower threshold is applied. Summarizing, I will examine the robustness of the results obtained by Chen et al (2008) in two ways: changing the period under consideration and lowering the threshold of battle deaths per year. The aim will be on the economic consequences; the social variables will be discussed less thorough.

3.2 Data

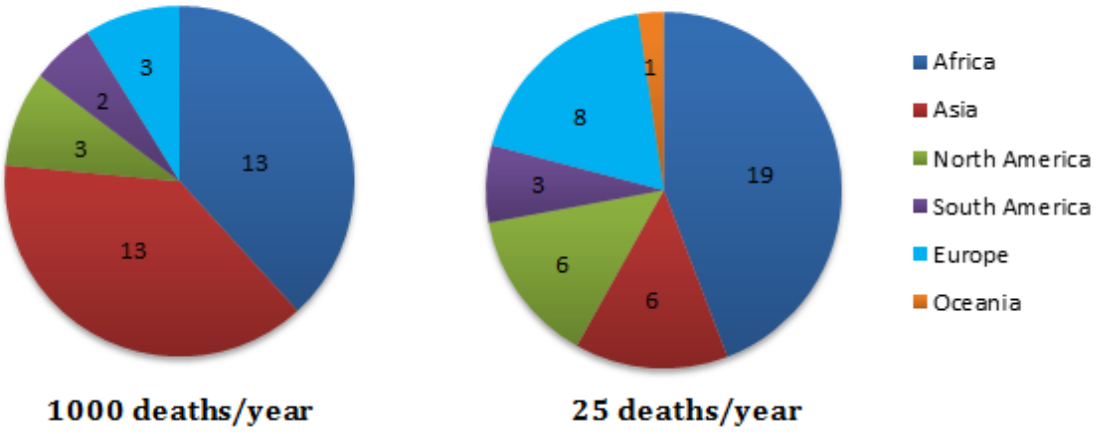
The data concerning civil conflicts comes from the PRIO-database, located in Oslo. The database is based on years per conflict. This indicates that a three-year conflict has three separate entries representing a year, each year having their own characteristics. Due to this reason, one conflict cannot completely be marked as a 25- or 1000-deaths conflict, and therefore two different datasets need to be constructed.

For the first dataset the threshold of 1000 battle deaths is used, as in accordance with Chen et al. For this, conflicts need to qualify as being a civil conflict (type=3) or a civil conflict with intervention from foreign states (type=4). Of course, only the years with a minimum of thousand battle deaths (Int=2) are taken into account. The conflicts need to start not before 1967 and need to end no later than 2005. This last date is required in order to get data for nine years following the war. This is very unfortunate, since fourteen conflicts qualify for the other requirements but end between 2006 and 2014. This is however interesting for future research when more post-war data will be available. Then, the conflicts with overlapping years or a gap smaller than twelve years are merged together. This leads to seven 'constructed' conflicts; Bosnia-Herzegovina, Ethiopia, India, Indonesia, Iran, Pakistan and Serbia. Conflicts starting or ending just before the cut-off points, but not experiencing twelve years of peace before and after are removed from the sample. Finally, 34 conflicts qualify for the 1000 deaths-threshold and other requirements for this dataset.

For the second dataset the lower threshold of 25 deaths is used. The same requirements are applied as to the first dataset, with exception of the threshold (Int=1 or 2, since the threshold of 25 also means conflicts with over 1000 deaths a year are qualified). Cutting of the data at 2005 now leads to forty-four conflicts being removed from the dataset after 2005. Though this seems illogical at first sight, some conflicts go on and on for years with relatively few casualties. Such conflicts are now merged with earlier conflicts more often (since the gap becomes smaller, as a result of the lower threshold) and these longer conflicts are more likely to violate the start or end-date. Finally, 43 conflicts qualify as a civil conflict when years with more than 25 battle deaths are taken into account. Of these 43, four are constructed conflicts; Bosnia-Herzegovina, Comoros, Morocco and Serbia.

Though the two datasets are different in size and thresholds, the average length (measured in whole years) of a conflict does not seem to change much. In the first dataset the average length is 7 years and 8 months, in the second dataset this is about four months shorter (7,65 versus 7,30). In the first

Figure 2: conflicts per continent



dataset the Angolan civil war is the longest with twenty-seven years (1975-2001), in the second dataset the Cambodian conflict is the longest (1967-1998). Figure 2 shows the spread of the conflicts in terms of continents for both datasets.

After having established the lists of conflicts that will be used for analysis, the remaining variables can be collected. First, this is done by adding characteristics of the civil conflicts to make things easier. The three-letter country codes and two-letter continent codes are added to each row. The duration of the conflict, calculated as the calendar years between t-1 and t+1, is also added.

The most important variable is the GDP per capita. It is extracted from the Penn World Tables 8.0 (PWT). The real GDP with chained 2005 purchasing power parity is used, in order to make comparison across different countries and points in time possible. The real GDP is extremely useful when comparing growth rates across time and countries.[1] From the PWT the population numbers are taken, which are used to calculate per capita GDP and per capita GDP growth. For some years data is unavailable, mainly for some early African conflicts. The advantage of having both the absolute GDP level and the GDP growth is that they both provide different information. Growth patterns can be the same, but the absolute GDP might be dozens of percentages lower after the conflict. The opposite can also happen, there is more growth after the conflict but the GDP level is equal. This will then indicate that it has nothing to do with catch-up growth. Using both these two variables will strengthen the outcome and will tell a more detailed and complete story.

The remaining variables are gathered from the World Bank, more specific the World Development Indicators. Military expenditures measure the percentage of government expenditures on military costs. The FDI measures the net inflow of Foreign Direct Investment, as a part of GDP. Government expenses as part of GDP are taken into account in the variable GovExp. Inflation is measured through consumer inflation. To measure the investment in the country, the national savings are used. The gross domestic savings (as part of GDP) are used to capture this.

As mentioned before, the social variables used by Chen et al (2008) are included as well. This is done mainly because of the robustness check performed on both the years under consideration and lowering the threshold. These will not be analyzed extensively, since the focus is on the economic consequences.

The social variables include mortality rates for females, males and infants per 1000 relevant persons (females/males/infants). To check the effect on education, the percentages of the population participating in primary and secondary school are used. Three age-dependency ratios are used. The

[1] This is further explained in the PWT 8.0 user guide, by Feenstra, Inklaar and Timmer (2013).

first one measures the number of young (under 15 years) or old (older than 64) as a percentage of the working population (between 15 and 65). The second one only measure the younger parts as a percentage of the working population, the third one only the old part. All these social variables are taken from the World Development Indicator database, provided by the World Bank. In addition, there will be dummies for conflicts. These dummies are required for the methodological approach.

3.3 Methodology

As mentioned earlier, the methodological approach of Chen et al (2008) will be adopted. The four regressions used are similar to those used by Chen et al. The main difference with the other methodology (introduced by Collier) is that Collier used decade average numbers. This means that in this way each conflict would have one number for the pre-war period and one for the post-war. The method used by Chen does not take averages but takes all the years into account for the regression. The main advantage is that the variance between the years is not lost, as would happen with a decade average. This is the main reason why I prefer the method used by Chen. A conflict will then be treated as t=0, and a maximum of nine years before and after the conflict are taken into account. Using a dummy, which is one for the post-war years, the two periods can be compared. This is a second advantage, since the value for the dummy directly gives the answer we are looking for (the difference between the post- and pre-conflict years). In formula, this looks like the following:

$$y_{i,t} = \alpha_1 + \alpha_2 * Post_i + \mu_i + \epsilon_{i,t} \quad \text{(I)}$$

Here, y stands for the dependent variable. This can by example be the GDP per capita or the GDP growth rate. α_1 stands for a constant. α_2 is the variable of interest. Because of the *post* dummy, which is thus coded as 1 for post-war years, this variable gives the average difference between the pre- and post-war period. A coefficient of 0.8 should imply that the post-war level of the dependent variable is on average eighty percent points higher than the pre-war period. μ_i is modelled as a country dummy, to control for country-specific effects. Finally, $\epsilon_{i,t}$ is the error term for the regression.

When the duration of the conflict is taken into account, regression (1) will become:

$$y_{i,t} = \alpha_1 + \alpha_2 * Post_i + \alpha_3 * Post_i * Dur_i + \mu_i + \epsilon_{i,t} \quad \text{(II)}$$

where *Dur* stands for the duration of the conflict. Here, α_3 will give the effect of each additional year the conflict lasts on the difference between the pre- and post-war period. The advantage of this methodology is the clear outcome. For each variable it clearly demonstrates the difference between the period before and after the conflict. A disadvantage is that the period under consideration might

strongly affect the results, since it is unlikely that variables have equal values in all the pre- and post-war years. If, by example, the first two years after a conflict lead to big losses, examining a five year period will give worse results than a nine year period. Because of this drawback, I intend to investigate the robustness.

As in accordance with Chen, the post-war period will also be investigated separately. This will also be done for the three different periods (5, 7 and 9 years) and the two different thresholds (25 and 1000 deaths a year). The resulting regression is quite similar to regression (1):

$$y_{i,t} = \beta_1 + \beta_2 * Year_t + \mu_i + \epsilon_{i,t} \quad \text{(III)}$$

Now, the main variable of interest is β_2, which will give the average change from year to year for the dependent variable. This is similar to estimating a trend in the pre-war years. *Year* is the absolute value of t during the post-war period (which will go from 1 till 9). When duration is added, the regression looks like

$$y_{i,t} = \beta_1 + \beta_2 * Year_t + \beta_3 * Dur_i * Year_t + \mu_i + \epsilon_{i,t} \quad \text{(IV)}$$

Here, β_3 will give the effect of an additional year of conflict on the per year average change in the dependent variable of interest. All the dependent variables will be compared by themselves, and are not compared to a control group. This needs to be taken into account when interpreting the results.

All regressions have been carried out in STATA 13 with clustered standard errors, based on the country code. These standard errors have the advantage that they relax the assumption of observations being independent within a cluster (a country here). Therefore this allows us to assume that observations within a country are not independent, though we still assume different clusters are independent on each other. This means we correct for possible correlation (of errors) within a country, but still assume there is no correlation between countries. By example in the case of economic growth this is a nice assumption to have, since it is likely that a large growth in one year might be correlated to growth in the next year.

IV - Results – economic growth

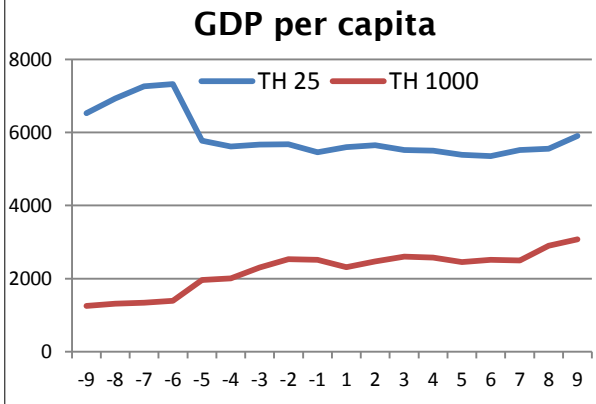
4.1 Introduction

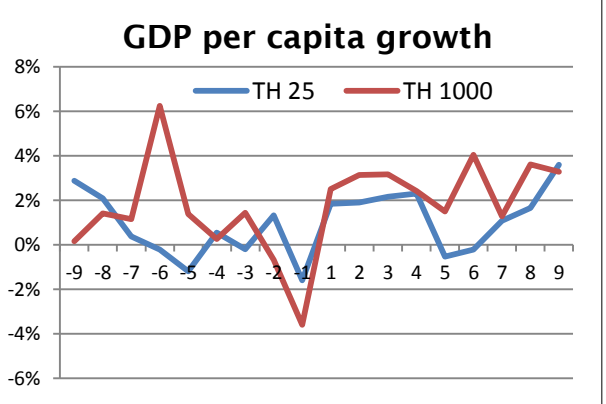
In this section the results will be discussed. Before the results of the regressions are presented, the average GDP level and growth at each time period are plotted in the graphs below. The left graph shows the average per capita GDP for each time period. The graph on the right shows the average GDP per capita growth rate for each time period.

The left graph shows a few interesting things. First, it shows that the average GDP level per capita is much higher in the dataset with a threshold of 25 casualties than in the one with 1000 casualties. The difference fluctuates, but varies between around four times to just over twice as high. This result is even more interesting if we take into account that the 25-dataset also consists of most of the 1000-dataset conflicts. The numerical difference is only nine conflicts, so a small amount of conflicts must cause the gap between both datasets. If adding nine conflicts to 34 'existing' ones leads to such a high difference, the GDP levels of these nine must be a lot higher than what the graph presents as the average. This implies that lowering the threshold to 25 leads to more developed countries qualifying for the dataset, compared to the 1000-dataset where the developing 'poor' countries are more present. A closer look at figure 2 shows that the lower threshold indeed increases the European conflicts from three to eight. A second thing the graph shows is that in the period before the conflict the GDP per capita is declining in the 25-dataset but is increasing in the 1000-one. After the conflict the two lines follow nearly the same pattern.

In the right graph, where the GDP growth per capita is shown, there are other interesting conclusions. It shows that 1000-dataset is much more sensitive to shocks. In general both lines possess the same pattern, but the peaks and dips are more extreme in the 1000-dataset than in the 25-one. Both show a major decrease in GDP growth just before the onset of the conflict, but this can be the result of a measurement issue. One last thing to notice is the major peak in the 1000-set

Figure 3: GDP over time





around t-minus six, the same moment the 25-set has a dip. The peak is caused by a 123% increase in GDP per capita for 1997 for Liberia. What emerges from both graphs are the different patterns in the first and last couple of years. This can imply that changing the period under consideration might indeed impact the results. For instance, removing the first and last two years from the left graph will yield to nearly a horizontal line for both datasets. It also shows that the GDP per capita level seems to follow a straight line after t-7, so the GDP level might not be lower after the conflict.

4.2 Pre- and postwar comparison

4.2.1 Base case (TH1000)

The starting base of the regressions will be similar as Chen et al (2008), namely a threshold of 1000 battle deaths a year and seven years before and after the conflict. Finally, one asterisk will indicate a coefficient is significant at the ten percent level, two will mean it is significant at the five percent level. Numbers reported between brackets are standard errors.

First the two main economic variables will be examined for the base case. These are the GDP per capita level and the GDP per capita growth rate. For the level of GDP per capita the logarithm is used. This is somewhat different than what Chen et al used (though they do not report what they exactly used), but because of the lower threshold used later on (and the larger gap between the datasets), using absolute GDP levels will lead to results which are not very helpful. By example, a significant variable with the coefficient 800 means that in one case the GDP per capita is 800 dollars higher. This tells little about the relative change; it changes a lot if the country has a 'normal' GDP of 1500 or 30000 dollars. Besides this, using absolute values will give the average absolute difference, but we are interested in the absolute relative difference between the pre and post-war level. Relative differences will make the comparison between the two different thresholds a lot easier. Taking the logarithms of the GDP per capita solves all these issues.

The first results are presented in table 1. Regression I does not uses the interaction term, regression II does. The first regression does not yield significant results, though the coefficients are not completely different from what Chen et al found. But this is not as expected, since they did found a significant relationship between the dummy and both the GDP growth (at ten percent) and the GDP level (at five percent). When comparing the standard errors and coefficients to the results found by Chen, it is likely that the combination of both lower coefficients and higher standard errors leads to the insignificant relationship. In the next regression (column 3) an interaction term (measuring the interaction between the duration of the conflict and the dummy) is added (regression II). This produces one significant result in column four for the GDP growth regression. This indicates that for each additional year a conflict lasts, the average per year GDP per capita growth is nearly 0.37

percent points higher after the conflict. This implies that a conflict has a positive impact on economic growth. The 'base' effect of civil conflict is still negative: the coefficient for *prepost* being -1.141. This indicates that a war leads to higher economic growth when a conflict lasts for four years. For the high threshold of 1000 casualties, over 70% of the conflicts last longer than three years, leading to the positive effect on economic growth. This result could be the result of the 'catch-up growth'. Catch-up growth is higher after a conflict because part is destroyed. However, the catch-up growth theory should also show a decline in per capita GDP (which would resemble the destruction). There is however no significant result indicating that the absolute GDP level is lower after the conflict, so the evidence for catch up growth is weak. Chen et al did not find a significant relationship with both the coefficient and the interaction term, so this is a different and interesting finding.

Table 1: Results TH1000 and 7 years

GDP level p/c (LOG)	Regression I	Regression II
Prepost	-0.023	-0.064
	(0.044)	(0.064)
Prepost * duration		0.005
		(0.006)
R-squared	0.950	0.947
Nr. obs.	400	400
GDP growth p/c	2	4
Prepost	1.724	-1.141
	(1.690)	(2.869)
Prepost * duration		0.368*
		(0.202)
R-squared	0.158	0.170
Nr. obs.	392	392

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country.**

Though the relationships, except one, are not significant we can say something about the sign. It is interesting to see that the *prepost* dummy is negative for all the level regressions, implying a lower per capita GDP as a result of the war. For the *prepost* dummy in the GDP growth regressions two are positive, implying a conflict could lead to higher growth levels. This is similar as what was expected. We cannot yet prove this since the results are insignificant, but it tells us something about the expected sign a relation is likely to have.

4.2.2 Base case (TH1000) – changing the period

This is where Chen et al stopped. As mentioned before, this thesis will investigate if the results change when (a) the years under consideration are shortened or extended, and (b) when the threshold is lowered from 1000 to 25. Since we started with the threshold of 1000 a year, we will now investigate the effect of lowering or extending the number of years with two.

Table 2: Results TH1000	Regression I			Regression II		
Years	**5**	**7**	**9**	**5**	**7**	**9**
GDP level p/c (LOG)						
Prepost	-0.041	-0.023	-0.011	-0.083	-0.064	-0.043
	(0.044)	(0.044)	(0.043)	(0.066)	(0.064)	(0.065)
Prepost * duration				0.005	0.005	0.004
				(0.007)	(0.006)	(0.006)
R-squared	0.948	0.950	0.945	0.949	0.947	0.946
Nr. obs.	292	400	499	293	400	499
GDP growth p/c						
Prepost	2.765	1.724	1.781	0.168	-1.141	-0.405
	(1.740)	(1.690)	(1.313)	(2.795)	(2.869)	(2.154)
Prepost * duration				0.328	0.368*	0.289*
				(0.194)	(0.202)	(0.167)
R-squared	0.211	0.158	0.092	0.223	0.170	0.100
Nr. obs.	285	392	491	285	392	491

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country.**

Table 2 shows the results of extending or shortening the timeframe. Regression I (the left side of the table) is the regression with country dummies but without the interaction term. Regression II has both the country dummies and the interaction term. The coding of the regressions corresponds with the methodological part. The columns with seven years are the same results as presented in table 1, but are reported for easier comparison.

The table shows that most regressions lead to insignificant results. The interaction term was significant for the GDP per capita growth in table 1, and remains significant when we extend the period to nine years. The coefficient becomes slightly smaller, indicating that the GDP growth is lower when the period is extended. When we extend the period to nine years, a conflict only needs to last for two years in order to get a positive effect. When the time frame is extended, both the general effect and the interaction term are lower. This result corresponds with figure 3 presented at the beginning of this section. The effect is likely to be more extreme close to the conflict and is smoothened when the time frame is longer. As we can see in figure 3, the first and last two years are relatively less intense, so this corresponds with our statistical findings. The interaction term becomes insignificant when we shorten the period to five years (though it is extremely close, with a p-value of 0.101), but the value is in between the coefficients of seven and nine years. This can also be explained by looking at figure 3; some of the 'stable years' are lost, but shortening the time frame

removes the peak at t-6 from the sample. This might explain why the effect is lower than with seven years.

Another variable that is close is the 5-year regression I for GDP growth (with the value of 2.765) with a p-value of 0.122. Considering the absolute values for the GDP per capita level for both regressions I and II, they become more negative when the period decreases from 9 to 5. Again, the coefficients are often not significant, so we cannot reject the null hypothesis of no effect and thus cannot base any conclusions on this. Concerning the significant results, it is interesting to see that the interaction term remains significant when we extend the period and becomes insignificant when the period is shortened, though the difference in p-values is extremely small. For this threshold there seems to be robust evidence showing that the duration is positively related with post-war economic growth.

4.2.3 Lowering the threshold: 25

Besides shortening or extending the period, the robustness can also be investigated by lowering the threshold. A lower threshold results in more conflicts qualifying as a 'civil conflict'. Besides checking if the significance of the coefficients changes, this can also tell us something about the difference in intensity. Table 3 shows the results of regression I and II with seven years under consideration. Lowering the threshold leads to the significant relation from table 1 (the interaction term between duration and GDP growth) becoming insignificant. Again, the difference is only small; the p-value of the insignificant variable is 0.120. Though it is slightly insignificant, the value of the coefficient changes as well; it drops with two-third. This can partly be explained by the appearance of the giant peak in the threshold of 1000 battle deaths a year. But since the second relation is insignificant, we cannot base hard conclusions on this. For as far as we

Table 3: Results with 7 years

	Threshold 1000		Threshold 25	
GDP level p/c (LOG)	I	II	I	II
Prepost	-0.023	-0.064	-0.150	-0.036
	(0.044)	(0.064)	(0.038)	(0.044)
Prepost * duration		0.005		0.003
		(0.006)		(0.007)
R-squared	0.950	0.947	0.951	0.952
Nr. obs.	400	400	488	488
GDP growth p/c				
Prepost	1.724	-1.141	0.832	0.027
	(1.690)	(2.869)	(0.777)	(0.941)
Prepost * duration		0.368*		0.120
		(0.202)		(0.075)
R-squared	0.158	0.170	0.231	0.235
Nr. obs.	392	392	483	483

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country.**

Table 4: Results TH25	Regression I			Regression II		
Years	**5**	**7**	**9**	**5**	**7**	**9**
GDP level p/c (LOG)						
Prepost	-0.012	-0.150	-0.015	-0.027	-0.356	-0.040
	(0.036)	(0.038)	(0.040)	(0.040)	(0.044)	(0.047)
Prepost * duration				0.002	0.003	0.004
				(0.007)	(0.007)	(0.007)
R-squared	0.960	0.951	0.950	0.959	0.952	0.947
Nr. obs.	350	488	623	350	488	623
GDP growth p/c						
Prepost	1.235	0.832	0.540	0.541	0.027	0.130
	(0.925)	(0.777)	(0.660)	(1.137)	(0.941)	(0.840)
Prepost * duration				0.104	0.120	0.061
				(0.073)	(0.075)	(0.061)
R-squared	0.303	0.231	0.155	0.305	0.235	0.156
Nr. obs.	345	483	616	345	483	616

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country.**

can speak of evidence, it shows that including the less intense conflicts (TH25) leads to a drop in the coefficient and significance level.

First we changed the period for the 1000 threshold dataset, and then we lowered the threshold. Now both will be combined, showing the difference when different timeframes are used for the 25-dataset. The results can be found in table 4. Not one variable is significant, though some are close at the ten percent level. Using the lower threshold, changing the period under consideration does not seem to change the significance of the results. Though the results are insignificant, the growth rates seem to drop when the years are extended. For all the level regressions, the coefficients are negative. For the growth regressions, all are positive. Though we have to be cautious due to the insignificance, the data again points in the direction of a lower level GDP with higher growth. Unfortunately, the relation is not strong enough to be statistically significant.

4.3 Post-war trends

4.3.1 Base case (TH1000)

The post-war period will also be investigated separately. For this, regression III and IV will be used. Here the variable for GDP level will show the actual GDP per capita growth per year, the value for GDP growth will now tell if the growth accelerates in the post-war period alone. The regressions that are similar to Chen et al, a threshold of 1000 and 7 years, will be presented first. Results can be found in table 5. Chen et al found a significant result for regression III with the GDP per capita level as dependent variable. The result found in table 5 is similar. The variable for 'year' is highly significant, even at the one percent level. It shows that the average year-to-year change in the post-war period is one percent for the GDP per capita level. This result is lower than the result found by Chen et al (around 3.6%). Unlike the earlier two regressions, there is no comparison with the pre-war period here, so the coefficient tells us nothing about the difference compared to the pre-conflict period. Though the result for the GDP level is significant here, the coefficient is small enough so that it might only reflect a normal economic growth pattern, and has nothing to do with the civil conflict. The other GDP level regressions are not significant. None of the regressions with GDP growth produces significant variables. For regression III this is similar to the results by Chen et al; for regression IV no significant relation appears where Chen et al did find a relation between both the year and the interaction term for both dependent variables.

Table 5: Results TH1000 and 7 years

GDP level p/c (LOG)	Regression III	Regression IV
Year	0.010**	0.006
	(0.003)	(0.004)
Year * duration		0.001
		(0.000)
R-squared	0.995	0.995
Nr. obs.	219	219
GDP growth p/c	2	4
Year	-0.085	-0.062
	(0.491)	(0.756)
Year * duration		-0.003
		(0.046)
R-squared	0.245	0.245
Nr. obs.	218	218

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country.**

As in the previous part, we will now change the period under consideration with the current threshold of 1000 casualties a year. Table 6 reports the results for the regressions with country dummies and the different time frames. It shows that the regressions without interaction term for the GDP per capita level remain significant in both the nine and five year case. The coefficient is

similar with three decimals in all cases. All three regressions show that the average year to year increase after the conflict is one percent per year. Again, this result is still small and it might only reflect usual economic development. For the GDP per capita level, regression IV with nine years also produces one significant result. The coefficient for year (0.007) is significant at the ten percent level, indicating an average year to year change of 0.7% during the post-war period. It is interesting to see that adding an interaction term does not change the significance of the nine year regressions, but it

Table 6: Results TH1000	Regression III			Regression IV		
Years	**5**	**7**	**9**	**5**	**7**	**9**
GDP level p/c (LOG)						
Year	0.010*	0.010**	0.010**	0.006	0.006	0.007*
	(0.004)	(0.003)	(0.002)	(0.007)	(0.004)	(0.004)
Year * duration				0.000	0.001	0.000
				(0.000)	(0.000)	(0.000)
R-squared	0.996	0.995	0.994	0.996	0.995	0.995
Nr. obs.	158	219	272	158	219	272
GDP growth p/c						
Year	-0.298	-0.085	0.088	-0.597	-0.062	0.206
	(0.780)	(0.491)	(0.373)	(1.250)	(0.756)	(0.556)
Year * duration				0.038	-0.003	-0.017
				(0.073)	(0.046)	(0.039)
R-squared	0.361	0.245	0.173	0.363	0.245	0.174
Nr. obs.	157	218	271	157	218	271

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country.**

does cause the other two regressions (five and seven years) to become insignificant.

4.3.2 Lowering the threshold: 25

Finally the threshold is lowered to 25 casualties a year. The corresponding results can be found in table 7. All interaction terms for the GDP per capita level are significant. All have the same (rounded) coefficient, meaning each additional year a conflict lasts will generate an additional 0.1% higher growth rate after the conflict, meaning the duration results in an acceleration of economic growth. To make this a bit clearer, imagine a conflict that lasts eleven years compared to a second conflict lasting only one year. The one year conflict will get a growth rate of 0.1% per year as a result of duration for the nine years following the conflict. The eleven year conflict will get a growth rate of 1.1% per year for the nine years after the conflict. This is an interesting result, showing that the GDP growth rate rises harder when the conflict lasts longer. The result is robust with respect to the

number of years, even in terms of the absolute value, but is not robust with respect to the threshold. It does seem to prove that the duration of a conflict can be seen as a determinant of the impact of a

Table 7: Results TH25	Regression III			Regression IV		
Years	**5**	**7**	**9**	**5**	**7**	**9**
GDP level p/c (LOG)						
Year	0.006	0.004	0.004	0.002	-0.002	-0.000
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Year * duration				0.001*	0.001**	0.001**
				(0.000)	(0.000)	(0.000)
R-squared	0.996	0.994	0.993	0.996	0.994	0.993
Nr. obs.	188	264	337	188	264	337
GDP growth p/c						
Year	-0.469	-0.334	0.040	-0.341	-0.516	0.064
	(0.560)	(0.351)	(0.236)	(0.743)	(0.477)	(0.313)
Year * duration				-0.018	0.025	-0.003
				(0.033)	(0.025)	(0.018)
R-squared	0.436	0.361	0.249	0.437	0.363	0.249
Nr. obs.	187	263	336	187	263	336

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country.**

conflict on the economic growth. All other variables are insignificant with the lower threshold of 25.

4.4 Summary

In this section the results with respect to the GDP level and growth were presented. First the pre- and post-war period were compared using regression I and II. The results produced by Chen et al could not be replicated with an updated dataset. The data used comes from the same database used by Chen et al, so it is unlikely that the different findings are caused by a data related issue. There are however three possible causes that *could* lead to these different effects: the updated dataset (so more conflicts included), the different way in which missing years were handled and the different standard errors used. This has been further investigated for the 7-year time period and regression I. Restricting the dataset to the years used by Chen et al did not lead to the same results as they found. Second, Chen et al placed a restriction on a minimum of seven years of available data in total (out of 14 years) which was required for a conflict to be investigated. Limiting the whole dataset to conflicts with this restriction again failed to reproduce the findings by Chen et al, even when the data was

limited to the period used by Chen et al. And even when the data was limited to countries with complete data (so GDP data for every year), no significant results were found for both the Chen period and the complete dataset. Both the 'new' conflicts and the different handling of missing data do not seem to change the significance of the results for both time periods (the period by Chen and the period in this thesis).

What did seem to have a significant effect is the use of clustered standard errors. When normal errors are used, which do not allow for possible correlation for observations within a country, the same effects are found when the dataset is restricted to the years used by Chen *and* the restriction of a minimum of seven years of data is applied. When this last restriction is loosened, the significance of GDP growth slightly changes. Even for the complete dataset used in this thesis significant results are found when normal standard errors are used. Changing the restriction on data availability (excluding conflicts with missing data) only slightly changes the results, but at least one of the two economic variables is always significant. To conclude on these three possible causes: the lack of significant results is most likely the result of the use of clustered standard errors. Excluding conflicts with limited data availability is of some impact on the coefficients, but is not as important as the standard errors. Updating the dataset with 'new' conflicts has the least effect when the other two causes are held constant. It should be noted that for the period with seven years not one significant result was found (for both thresholds) when the clustered errors were used, whatever the restriction on the data availability or the period (Chen or complete) was. Only changing the restriction on data availability or limiting the time frame on its own thus has little effect.

But the regressions with clustered errors also showed new, interesting findings. In the database with the higher threshold, evidence has been found indicating a positive effect of conflict duration on the economic growth rate. This can be even 0.37 percent points per year higher after the conflict compared to before, for each additional year a conflict lasted. A conflict needs to last for four years in order to get a positive effect. When we look at the results with nine year of data, a conflict only needs to last for two years in order to lead to a positive effect on GDP growth. The significance of the effect showed to be quite robust to the period used, as it is found for the nine year period and is hardly insignificant for the five year level. It is worth noting that the effect on GDP growth is highest with a period of seven years used. In the sample with the low threshold, the significant relationship was not found. This seems to imply that only for the more intense conflicts (in terms of battle deaths) there is an effect of conflict duration on economic growth. When the less intense conflicts (the lower threshold) are included no significant relationships are produced. It shows a conflict no longer has an effect on the GDP level and growth when smaller conflicts are included.

When only the post-war period is examined, there is robust evidence that the increase in GDP per capita is one percent per year after the conflict. This might only be normal economic growth, and since we found no significant difference between pre- and post-war GDP growth in table 2, it is unlikely that this result is different from the post-war period. When the threshold is lower, there is strong evidence that an additional conflict year causes the GDP growth to increase with 0.1% per year after the conflict. There is thus a normal trend in per capita GDP when only the most severe conflicts are examined. When the less intense conflicts are added there is no longer an annual increase in GDP, but there is a robust relationship between duration and GDP per capita. When we take into account that the average conflict lasts roughly 8 years, the difference is only small: one percent (TH1000) compared to 0.8% (TH25).

V - Results - economic indicators

5.1 Comparing pre- and post-war

5.1.1 Introduction

In the previous part the results with respect to the two economic variables were reported. Not many significant results were found, so it remains hard to say something about the effect of civil conflict on the overall economy. We will therefore take a closer look at some of the indicators of economic growth. It might be the case that the overall effect is small, but that does not mean nothing happens to individual indicators. In addition additional evidence for the last two hypotheses, dealing with the different time periods and thresholds, will be collected. All time periods and thresholds will be used. The regressions are, in accordance with the previous results, run with country dummies and clustered standard errors. The variables include some economic indicators and social variables originally investigated by Chen et al, but also a couple of new interesting variables. Table 8 shows the results for the first regression (without interaction term) for both thresholds and all time periods.

5.1.2 Economic indicators

The first variable is the military expenditures, measured as part of the GDP. The results are significant and quite robust in the 1000-set, with on average a decline of two percent points (as % of GDP) after the conflict has ended. It is not a surprising result to see that the military expenditures drop after a conflict has ended, though this contradicts the report of the World Bank (2003). Chen et al (2008) also found a decrease in military expenditures following the end of a conflict, though the results found here are twice as high. When the less intense conflicts are included, the drop in military expenditures is higher. The more intense conflicts thus have a smaller decline in military expenditures after the conflict.

Four other economic variables are in table 8: the foreign direct investments (FDI), government expenditures, inflation and the gross domestic savings. Inflation is not significant in any regression. The FDI and government expenditures are only significant in the 1000-set. The longer the period is, the higher the (positive) difference in FDI is between the pre- and post-war period. This is logical: a longer period of stability and peace will attract foreign investments, similar as in the case of tourism. Government expenditures drop after the conflict, but less in the 9-year case. Chen et al (2008) also found a significant drop in government expenditures after the conflict, though the results are larger here. Changing the threshold leads to insignificant results for both FDI and government expenditures, indicating that only for the more intense conflicts there is an effect on these economic indicators. The final economic variable, the gross domestic savings, seems to be quite robust with respect to the

threshold. For both thresholds negative effects are found, leading to a decrease of savings after the conflict. Chen et al (2008) did not examine this variable, but did investigate the effect on investment. They found a positive effect of conflict on the investment share. It might be logical that when investments go up after a war (since there is some rebuilding needed), this partly comes from savings.

5.1.3 Health

The next three variables all deal with mortality rates. The coefficients are higher than with other variables, but need to be interpreted differently here. They represent the average change per 1.000 males/females/births. All eighteen regressions are highly significant and all mortality rates are robust, not only in terms of significance but also in the absolute values. They all are more negative (so a lower mortality rate) when the period is extended, which is clearly a positive thing. This indicates a positive effect of civil conflict on the mortality rates, an important indicator of the health in a country. Chen et al (2008) also found the positive effect of civil conflicts on mortality, but this was only so when they are not compared to control groups. When they compared to control groups, they found that the effect disappears. The results here are thus likely to reflect better healthcare through time, instead of a consequence of civil conflict. The fact that the results are similar when the threshold is lowered, adds to the belief that this might actually be a development through time instead of a relationship related to the conflict. This could then even lead to the results by Ghobarah, Huth and Russet (2003) who actually found that civil conflicts might increase the amount of diseases.

5.1.4 Social variables

The school enrollment rates (in percentages) seem to have the same pattern as the mortality rates. All regressions are highly significant and extending the number of years leads to a higher positive effect. This is in accordance with Chen et al (2008) and Buckland (2005), where the latter found that post-conflict countries are actually open to change and that this has a positive impact on education. Though the mortality rates might show the effect of better health, the results here cannot be caused by better education since the enrollment rates says nothing about the quality. Chen et al also found significant positive effects when compared with control groups. The difference in enrollment numbers is higher in the 1000-set, but this is as expected. As concluded from the graphs, the 25-set seems to consist of more developed countries which are likely to have higher enrollment rates than less developed countries. This is probably the reason for the difference in coefficients.

The last four variables are the GINI coefficient and three age dependency rates. The GINI coefficient is never significant, though this might be partly explained by the low number of observations. An interesting thing to notice is that the coefficient is negative in the 1000-set, but always higher than

one in the 25-set. Though the regressions are insignificant, it seems to imply a more equal situation (a lower GINI) in the conflicts with more than 1000 casualties, but a less equal situation in the 25-case (with more developed countries).

Finally the age dependency ratios will be discussed. The ratios measure the number of people relative to the group aged 15-64 (the 'working population') for young (age dependency young), old

Table 8: Results regression I	TH1000			TH25		
Years	**5**	**7**	**9**	**5**	**7**	**9**
Additional economic indicators						
Military expenditures	-2.306**	-2.083**	-2.573**	-2.222	-3.104*	-4.114**
	(0.000) / 73	(0.000) / 106	(0.000) / 141	(1.557) / 73	(1.568) / 103	(1.701) / 137
FDI	0.788*	1.339**	2.228**	-0.114	0.306	1.181
	(0.448) / 257	(0.444) / 357	(0.903) / 449	(1.109) / 332	(0.986) / 459	(1.083) / 578
Government expenditures	-5.082**	-5.404**	-4.125**	-1.064	-0.399	0.818
	(0.000) / 80	(0.000) / 115	(0.000) / 150	(2.332) / 76	(2.514) / 106	(3.141) / 140
Inflation	-314.58	-246.92	-205.32	-80.191	-60.134	-49.264
	(316.3) / 234	(241.3) / 329	(190.5) / 422	(64.41) / 263	(46.30) / 377	(37.06) / 489
Gross domestic savings	-7.581**	-5.658*	-4.215	-4.245	-4.494*	-4.611*
	(3.191) / 283	(2.854) / 390	(2.672) / 487	(2.762) / 377	(2.662) / 525	(2.642) / 664
Health						
Female mortality	-30.777**	-36.749**	-41.497**	-30.932**	-35.859**	-40.312**
	(6.411) / 336	(6.573) / 469	(6.914) / 590	(10.79) / 430	11.802 / 602	(12.19) / 768
Male mortality	-27.020**	-32.273**	-37.226**	-33.095**	-37.450**	-41.493**
	(8.624) / 336	(7.878) / 469	(7.569) / 590	(10.49) / 430	(11.34) / 602	(11.68) / 768
Infant mortality	-23.668**	-27.805**	-31.931**	-23.005**	-26.973**	-30.376**
	(3.081) / 329	(3.281) / 457	(3.547) / 578	(3.968) / 424	(4.286) / 591	(4.415) / 748
Social variables						
Primary school enrollment	11.141**	13.495**	15.053**	7.586**	9.285**	10.061**
	(4.984) / 248	(4.803) / 341	(4.546) / 423	(2.664) / 315	(2.914) / 432	(2.964) / 537
Secondary school enrollment	12.735**	14.486**	15.896**	8.828**	10.488**	11.743**
	(3.352) / 215	(3.440) / 285	(3.199) / 355	(2.618) / 263	(2.690) / 359	(2.508) / 448
Age dependency	-5.007**	-5.786**	-6.512**	-6.212**	-6.890**	-7.613**
	(1.779) / 336	(1.898) / 470	(1.998) / 597	(1.327) / 426	(1.406) / 596	(1.477) / 762
Age dependency old	0.616**	0.688**	0.757**	0.790**	0.913**	1.029**
	(0.244) / 336	(0.269) / 470	(0.298) / 597	(0.269) / 426	(0.301) / 596	(0.339) / 62
Age dependency young	-5.623**	-6.474**	-7.269**	-7.001**	-7.804**	-8.641**
	(1.806) / 336	(1.921) / 470	(2.014) / 597	(1.337) / 426	(1.412) / 596	(1.478) / 762
GINI coefficient	-3.250	-0.673	-0.477	1.562	1.743	1.179
	(2.523) / 48	(1.380) / 70	(1.121) / 91	(3.987) / 47	(3.686) / 64	(3.444) / 85

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country. Number after the slash is the number of observations.**

(age dependency old) or both (age dependency). They are highly significant in all regressions. The age dependency and age dependency young (measured as the number of dependent people per 100 people from the working population) are more negative for both thresholds when the number of years is increased, indicating the working population increases and/or the other groups decline. This is similar as what Chen et al found, though they state this might be a demographic transition. Since they are negative, the working population is not likely to be declined, as would be logical as a result of a conflict. The age dependency old becomes more positive when more years are added. This indicates the population is aging, and could very well be a demographic transition as well.

5.2 Duration

Chen et al did compare the pre-war period with the post-war period, but only with regression I and not with an interaction term. In order to have more evidence regarding the robustness and in order to explore possible new relations with the duration of the conflict, regression II will be run for all the additional variables as well. Results can be found in table 9 (TH25) and 10 (TH1000).

5.2.1 Economic indicators

When adding an interaction term, the significant relation with the military expenditures disappears for all time periods with the 25TH. This is an interesting finding. But in table 10, with a threshold of 1000, all three regressions produce significant results. In general, shortly after the conflict the military expenditures are two to three percent points (as part of GDP) lower than before the conflict, and duration has an additional negative effect. But when the period examined becomes longer, the additional effect of duration becomes a positive effect. Though there is no straightforward explanation, this could mean longer conflicts lead to more divided countries, where in the long run higher military expenditures are required in order maintain peace or the regime installed after the conflict. However, the variable for *prepost* becomes more negative; this should more than offset the additional increase in the interaction term when the period is extended.

FDI produces one significant result in table 9, with nine years: each year a conflict lasts will lead to a 0.38 percent point increase in FDI as part of the GDP in the 25TH. In table 10 this result is not reproduced, but the shorter timeframes indicates an effect of conflict on FDI growth ranging between 0.12 and 0.20 percent points for each conflict year. Both show a positive effect of conflict duration on foreign direct investments. This is a surprising result: a longer conflict attracts more foreign investments, which contradicts the statement that more stability and shorter conflicts have a positive effect on FDI. On the other hand, after a longer conflict there is more to rebuild and more funds are needed, which will partly come from abroad.

Government expenditures are significant for all variables in both tables, but show an interesting pattern. With the less intense conflicts (TH25) there is a 'standard' higher expenditure after the conflict varying between 4 and 7 percent points (as part of GDP), but it is declining with the duration of the conflict (around 1.2 percent points for each year a conflict lasted). But with the higher threshold, this is exactly the opposite. There is a lower government expenditure after the conflict (of around 4 to 5 percent points), and an additional rise in expenditure for every year the conflict lasts between 0.2 and 0.3 percent points (as part of GDP). It is a surprising finding that changing the threshold can completely lead to the mirror image. A plausible explanation might be that with the less intense conflicts, and thus more developed countries, higher expenditures are actually an economic development and the negative effect of duration is the real cost of war. For less developed countries (read: only the more intense conflicts), the expenditures are lower after the conflict, since it is likely that a devastating war leads to lower government income and thus expenses. But the longer the conflict lasts, the more development aid might flow into a country, explaining the positive effect of duration on government expenses for the high threshold. A second explanation might be that the more devastating the conflict is, the more there has to be reconstructed, so the government needs to raise its expenses.

The last economic variable is the gross domestic savings. This is insignificant for the low threshold, but produces significant results in table 10 (TH1000). It shows that on average the savings drop with around eight to twelve percent points (as part of GDP) after the conflict and there is a minor positive effect from duration on savings. This indicates a high drop shortly after the conflict (and/or a high increase in savings just before the conflict). This is an example where extending the period leads to the smoothing of the effect: it becomes lower and looks less intense then when only a few years are taken into account But when a war lasts longer, the savings are higher after the conflict than before: each additional conflict-year causes a 0.5 to 0.7 percent point rise in savings. People might be a bit more cautious with spending when conflicts are more devastating, though on average they still erode their savings.

5.2.2 Health

For the low threshold, there is an effect from duration on all mortality rates, which is quite stable when the period is extended or shortened. This result disappears when we only examine the more intense conflicts. The male and female rates are still lower after the conflict, but are unrelated to the duration, which again strengthens the suspicion that this might actually be a trend in time. The infant mortality rate is significant for both thresholds, for both the dummy and the duration. This indicates that each additional year of conflict leads to an additional decrease in mortality rates. This can

however still be an effect of time: the longer a conflict lasts, the more developments there can be in healthcare and these might then be wrongfully assigned to the duration of the conflict.

5.2.3 Social variables

The primary school enrollment rates do not produce interesting findings. The secondary school enrollment rates show that for each year a conflict lasts, an increase of around one to two percent points in enrollment rates takes place after the conflict. The rise is higher in case of the lower threshold, so when the less intense conflicts are taken into account. It might demonstrate the relationship Buckland (2005) found: post-conflict countries are more open to change and this might cause better educational systems. When a conflict lasts longer, ceteris paribus more will be destroyed, so this might make a new or reformed system more feasible.

Finally the age dependency rates are presented. Age dependency old leads to insignificant results in most regressions. Age dependency is significant in all the 25TH regressions, but this disappears for most variables when the threshold is increased. All variables are negative, indicating less people are depending on the working population, and the evidence is stronger with the use of the lower threshold. For the age dependency young the findings and conclusions are similar. With the lower threshold and thus including the less intense conflicts, it seems to lead to stronger evidence that less people are depending on the working population. When only the more intense conflicts are examined duration is never significant. We can therefore assume the relationships found using the lower threshold are unrelated to conflict, as they otherwise should appear for the more intense conflicts as well. This might simply represent demographical developments.

5.3 Summary

In this section the effects of conflict on additional variables were discussed. It showed most economic variables experience effects from a civil war. Military expenditures, savings and expenditures drop after the conflict. The military expenditures and savings are robust to the threshold, but government expenditures only drop for the more intense conflicts. On the other hand, FDI improves after a conflict, but only for the high threshold. Overall we can say that the economic indicators are all in some way affected by civil conflict, at least compared to the pre-war situation. When we include the less severe conflicts, only the military expenditures and savings remain significant. For the social variables, we have seen that mortality rates drop significantly after the conflict. We have to be aware since this could reflect normal health developments over time. The results are however robust to the thresholds and all time periods. The age dependency ratios showed significant relations with the conflict as well, though the working population seems to be

higher after the conflict, which contradicts expectations. This can however be a normal demographic transition.

Duration has a negative effect on military expenditures, but when the period is longer this reverses to a positive effect. A longer conflict leads to more foreign investments in the post-war period, which might be due to development aid. Another interesting finding is that the government expenditures are positively related to duration for the high threshold, and negatively for the lower threshold. The mortality rates seem to be related to duration as well, though this can again be a result of developments through time. Enrollment rates are also related to duration, where a longer conflict leads to higher enrollment rates when the conflict has ended. Overall we can conclude that the duration has a significant effect on most economic and social variables. Though this has not been extensively investigated for most variables, this adds up to the results by Collier (1999), who found the length of conflicts is of impact on the economy.

Table 9: Regression II with TH25 – estimated coefficients for *prepost* (difference between pre/post-period) and interaction with duration						
	5 years		7 years		9 years	
	Prepost	Interaction	Prepost	Interaction	Prepost	Interaction
Military expenditures	-0.649	-0.503	-1.481	-0.537	-2.662	-0.494
	(2.569) / 73	(0.581) / 73	(2.259) / 103	(0.502) / 103	(2.360) / 137	(0.533) / 137
FDI	-0.870	0.130	-0.491	0.139	-1.003	0.387**
	(1.730) / 332	(0.120) / 332	(1.530) / 459	(0.107) / 459	(1.383) / 578	(0.188) / 578
Government expenditures	4.160*	-1.027**	4.881**	-1.103**	6.995**	-1.351**
	(2.234) / 76	(0.250) / 76	(1.926) / 106	(0.220) / 106	(2.248) / 140	(0.245) / 140
Gross domestic savings	-0.469	-0.497	-1.379	-0.414	-1.943	-0.366
	(2.670) / 377	(0.466) / 377	(2.765) / 525	(0.436) / 525	(2.782) / 664	(0.455) / 664
Female mortality	4.371	-4.834**	0.911	-5.035**	-4.418	-4.983**
	(14.026) / 430	(1.571) / 430	(15.954) / 602	(1.628) / 602	(17.047) / 768	(1.626) / 768
Male mortality	-0.081	-4.521**	-2.954	-4.724**	-7.907	-4.663**
	(13.386) / 430	(1.529) / 430	(14.993) / 602	(1.585) / 602	(15.986) / 768	(1.585) / 768
Infant mortality	-8.679**	-2.129**	-12.529**	-2.136**	-15.746**	-2.154**
	(3.977) / 424	(0.706) / 424	(4.576) / 591	(0.784) / 591	(4.930) / 748	(0.795) / 748
Primary school enrollment	3.203	0.939*	5.133	0.884	5.390	0.997
	(3.483) / 315	(0.540) / 315	(3.929) / 432	(0.578) / 432	(3.960) / 537	(0.605) / 537
Secondary school enrollment	1.847	1.639**	2.970	1.723**	4.471**	1.574**
	(1.841) / 263	(0.549) / 263	(1.969) / 359	(0.542) / 359	(1.919) / 448	(0.420) / 448
Age dependency	-2.613**	-0.495**	-3.378**	-0.483**	-4.193**	-4.762**
	(1.294) / 426	(0.165) / 426	(1.489) / 596	(0.177) / 596	(1.707) / 762	(0.193) / 762
Age dependency old	0.441	0.048	0.556	0.049	0.661*	0.051
	(0.304) / 426	(0.029) / 426	(0.350) / 596	(0.031) / 596	(0.391) / 762	(0.034) / 762
Age dependency young	-3.054**	-0.543**	-3.934**	-0.532**	-4.855**	-0.527**
	(1.243) / 426	(0.155) / 426	(1.433) / 596	(0.166) / 596	(1.649) / 762	(0.183) / 762

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country. Number after the slash is the number of observations.**

Table 10: Regression II with TH1000 - estimated coefficients for *prepost* (difference between pre/post-period) and interaction with duration						
	5 years		7 years		9 years	
	Prepost	Interaction	Prepost	Interaction	Prepost	Interaction
Military expenditures	-1.812**	-0.247**	-2.374**	0.146**	-2.897**	0.162**
	(0.000) / 73	(0.000) / 73	(0.000) / 106	(0.000) / 106	(0.000) / 141	(0.000) / 141
FDI	-0.773	0.206**	0.393	0.125**	1.965	0.035
	(0.469) / 257	(0.044) / 257	(0.712) / 357	(0.060) / 357	(1.818) / 449	(0.135) / 449
Government expenditures	-5.769**	0.343**	-5.956**	0.276**	-4.489**	0.182**
	(0.000) / 80	(0.000) / 80	(0.000) / 115	(0.000) / 115	(0.000) / 150	(0.000) / 150
Gross domestic savings	-12.857**	0.754*	-9.914**	0.600*	-7.515*	0.461
	(5.210) / 238	(0.404) / 238	(4.504) / 390	(0.336) / 390	(4.025) / 487	(0.293) / 487
Female mortality	-25.632**	-0.661	-29.595**	-0.918	-33.489**	-1.042
	(9.253) / 336	(1.433) / 336	(9.956) / 469	(1.344) / 469	(10.143) / 590	(1.333) / 590
Male mortality	-15.418	-1.491	-19.555*	-1.632*	-24.517**	-1.653*
	(12.434) / 336	(0.993) / 336	(11.249) / 469	(0.927) / 469	(10.572) / 590	(0.947) / 590
Infant mortality	-12.366**	-1.640**	-17.271**	-1.530**	-22.177**	-1.424**
	(3.912) / 329	(0.462) / 329	(4.557) / 457	(0.483) / 457	(5.234) / 578	(0.507) / 578
Primary school enrollment	2.611	1.075	4.028	1.146	5.121	1.206
	(7.536) / 248	(0.916) / 248	(7.077) / 341	(0.801) / 341	(6.917) / 423	(0.762) / 423
Secondary school enrollment	3.696	1.003**	5.184	1.066**	7.781*	0.970**
	(4.017) / 215	(0.448) / 215	(4.300) / 285	(0.472) / 285	(3.995) / 355	(0.445) / 355
Age dependency	-4.015	-0.130	-4.810*	-0.128	-5.775**	-0.097
	(2.451) / 336	(0.332) / 336	(2.665) / 470	(0.350) / 470	(2.821) / 597	(0.362) / 597
Age dependency old	0.559	0.007	0.659	0.004	0.766	-0.001
	(0.393) / 336	(0.289) / 336	(0.439) / 470	(0.031) / 470	(0.487) / 597	(0.034) / 597
Age dependency young	-4.574*	-0.138	-5.469*	-0.132	-6.542**	-0.096
	(2.493) / 336	(0.346) / 336	(2.693) / 470	(0.365) / 470	(2.833) / 597	(0.377) / 597

***=significant at ten percent, **=significant at five percent. Numbers between brackets are clustered standard errors, based on country. Number after the slash is the number of observations.**

VI - Conclusions

In this section the most interesting findings will again be pointed out and limitations will be discussed. First, the evidence regarding the hypotheses will be discussed.

The first hypothesis stated that a conflict has a positive effect on post-war economic growth levels, but that this might be the result of a lower absolute GDP. Not many results were found in both thresholds, but the variables that *were* significant produced positive variables. Though there is no convincing evidence there is a clear, positive relationship with GDP, there certainly is no evidence indicating the absolute GDP level is lower after the conflict. When we investigate the post-war period alone we get different results. Here it is not the GDP growth where the significant results are found, but the GDP level produces significant results. The post-war period is investigated separately, so here a coefficient no longer indicates the difference with the pre-war level but only a trend in GDP level after the conflict (and thus economic growth). All three variables were significant for the GDP per capita level in table 6, showing actually a 1% increase in post-war year-to-year growth. These results are not compared to the pre-war period, so it might only be normal economic growth. There is however no evidence regarding a *negative* impact of conflicts on both the growth and level.

The second hypothesis dealt with the effect of duration on economic growth, and expecting a positive effect. When the economy is disrupted, much is destroyed and when the infrastructure is weakened it is easier to grow since there is much to rebuild. Collier (1999) found a negative relation between the number of months a country is at war and the economic growth level in the decade following. When comparing the pre- with the post-war period, there is some evidence that duration can affect yearly growth with around 0.37 percent points for each conflict year in the 1000-set (with seven years used), though a conflict should last for at least four years in order to get a positive effect. This is not found in the 25-dataset. But when only the post-war period is investigated, the evidence is found in the 25-set (with 0.1% additional growth for each conflict year) but is not present when the threshold is higher. The results for the lower threshold are quite robust to time periods. This is in line with Collier, who found that longer conflicts might actually have positive effects on economic growth. Each additional year a conflict lasts will cause 0.1% additional economic growth, and this result is quite robust. This all indicates that there is evidence that duration of a conflict has a positive impact on the post-war economic growth level.

The third hypothesis stated that more intense conflicts cause more economic damage. Since all the results found indicate a positive effect from conflicts on the economic growth and no evidence is found regarding a lower per capita GDP, the hypothesis is unlikely to be true. It might however be

the fact that the more intense conflicts have a smaller growth than the less intense dataset, and we can speak of 'damage' through the consequence of lower (but still positive) growth. However, given the little evidence that emerged from the two economic variables, it will be hard to give an answer. Significant relationships are found in different places and hard to directly compare between thresholds. A decisive answer cannot be given.

As noted before, the lack of significant results compared to Chen et al is likely to be the result of the use of clustered standard errors (as compared to normal, which are less strict). Placing restrictions on data availability can be of some extent, as can be the updated dataset. However not one significant regression was produced for the seven year period with regression I when clustered errors were used, whatever the other two restrictions were.

The fourth and fifth hypotheses both dealt with the robustness of the results and are more methodology-related. The evidence on the first two economic variables is mixed. Most relationships found are robust with respect to the number of years. But only robust when that means that they remain significant. The coefficients can change with a reasonable amount (table 2), but can also remain at the same level (table 6 & 7). The two economic variables seem to show that results are not robust to lowering the threshold, but are robust (up to a point) with respect to the number of years, though the coefficients can change.

A number of additional variables were examined in order to get more results to answer these two last hypotheses. The evidence here is mixed as well, and the answer will be 'it depends'. When we look at table 8, we see that for the first five economic variables the results or coefficients change when the threshold is lower, though two remain significant. Mortality rates are quite robust to both thresholds, but this can be caused by developments in healthcare over time. Speaking in terms of significance, the social variables are robust when the threshold is lowered. One thing that clearly emerges from table 8 is that lowering or extending the number of years clearly affects coefficients, as they always in- or decrease, but often do remain significant.

The regression including the interaction term (II), gives a different image. For the additional economic variables it shows that changing the threshold can lead to results becoming insignificant (military expenditures and gross domestic savings). It shows the pattern and sign of the coefficients can change when the threshold is lowered (government expenditures) or that results are simply not reproduced (FDI). Lowering the threshold can lead to the interaction term becoming significant (female mortality and male mortality) or it might simply just change the value of the coefficient a bit, but does not impact the significance (infant mortality). The enrollment rates seem to be quite robust with respect to the significance, but not with respect to the value of the coefficients. Concerning the

number of years used, both table 9 and 10 shows that when the number of years changes the effect on the coefficient is large.

The evidence shows that both the threshold and the amount of years can greatly impact the results. In terms of significance, when less intense conflicts are taken into account, some variables (often the social ones) are robust to a different threshold when others are clearly not (the economic variables). The value of the coefficients will almost always change when the threshold is different, even when they remain significant. When the number of years is in- or decreased, the effect is a change in the coefficient. A good example is the results from table 2: with seven years a conflict leads to positive effects on GDP when it lasts for a minimum of four years, when nine years are examined this is reduced to two. This indicates it is important to choose the time frame you are investigating and the threshold used. Including less intense conflicts can wipe out the results. For most economic variables, it also shows that results are more intense with a lower time period, so most effects seem to take place just before and after the conflict. For social variables it is often the other way around.

So what have we learned? Based on the data, we can say there is some evidence that civil war positively affects economic growth, and most likely through conflict duration. This relationship is found using the high threshold, and disappears when the lower threshold is applied. The result in the high threshold is also found by Collier (1999) with a different methodology. We can however not conclude that the level of the GDP is declining during the conflict. We can say that civil conflict leads to negative effects on government expenditures and savings, though the former is only found when the more intense conflicts are examined. We also learned that the less intense conflicts are often taking place in more, developed countries since they cause the average GDP to rise significantly. For the high threshold conflicts seem to have a positive effect on FDI, especially through duration, most likely to be a result of development aid.

Contradicting the report by the World Bank (2003) it seems that conflict countries lower their expenses on defense after a conflict. It showed that changing the time period under consideration, which is often very arbitrary, leads to different results. It turned out for most variables the effect is largest around the conflict. Extending the investigation period might smooth out the results. In general we can say that for the economic variables the effects are high around the conflict, so extending the period attenuates the effects. The mortality rate and the FDI seem to improve as time passes, so results are higher when the period is longer. We learned that changing the threshold can impact the significance of the results, where in other cases it does not. Especially the economic variables are vulnerable to a different threshold, and only found when the higher threshold is used. This result also carries through when the interaction term is added. The social variables often remain

significant, but they have to be interpreted with caution. And that is where one of the limitations of this research comes in. Finally, we learned that the use of stricter standard errors can invalidate earlier regressions. Limiting the decades under consideration or placing some restrictions on data availability can impact results as well, but seems to be less important, especially in terms of significance.

A clear limitation of this thesis is that the results are not compared to a control group. Results found only indicate a difference in a conflict country over time, comparing a pre- and post-situation in conflict countries itself. Especially for the mortality rates it is likely that time impacts the relationships, though it is not likely that the other (economic) variables are in any way affected. Another limitation is that the current available data only allows to use two different thresholds. Heterogeneity between conflicts is still small during analysis in this way. However since the nineties data is collected on actual casualty numbers, so in ten years' time the time frame will be long enough to make predictions using actual numbers. More research is needed in this area.

VII - References

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VIII – Appendix

Table A.1 – Data used and source			
Variable	Data name	Meaning	Source
GDP output	GDP_output	-	Penn World Tables 8
Population	Population	-	Penn World Tables 8
GDP per capita	GDP_PC	GDP per capita data calculated from GDP_output and population	Penn World Tables 8
GDP per capita growth rate	GDP_PC_GR	GDP per capita growth rate calculated from GDP_output and population	Penn World Tables 8
Military expenditures	MilExp	(% of central government expenditure)	World Bank
Foreign Direct Investments	FDI	Net inflows (% of GDP)	World Bank
Government expenditures	GovExp	Expense (% of GDP)	World Bank
Inflation consumer	InflC	Inflation, consumer prices (annual %)	World Bank
Gross Domestic Savings	GDS	Gross domestic savings (% of GDP)	World Bank
Female mortality rate	FemMort	Mortality rate, adult, female (per 1,000 female adults)	World Bank
Male mortality rate	MaMort	Mortality rate, adult, male (per 1,000 male adults)	World Bank
Infant mortality rate	InfMort	Mortality rate, infant (per 1,000 live births)	World Bank
Primary school enrollment rate	PriSchool	School enrollment, primary (% gross)	World Bank
Secondary school enrollment rate	SecSchool	School enrollment, secondary (% gross)	World Bank
Age dependency	Agedep	Age dependency ratio (% of working-age population)	World Bank
Age dependency Old	AgedepOld	Age dependency ratio, old (% of working-age population)	World Bank
Age dependency Young	AgedepYoung	Age dependency ratio, young (% of working-age population)	World Bank
GINI coefficient	GINI	GINI index (World Bank estimate)	World Bank

Table A.2 – Conflicts in TH1000 dataset			
PRIO ID	Country	Start of conflict	End of conflict
1-191	Algeria	1994	1999
1-131	Angola	1975	2001
1-193	Azerbaijan	1992	1994
1-203 + 194	Bosnia-Herzegovina	1992	1995
1-90	Burundi	2000	2002
1-103	Cambodia (Kampuchea)	1967	1978
1-92	Colombia	1985	2005
1-214	Congo	1997	1998
1-120	El Salvador	1981	1989
1-133 + 219 + 70 + 78	Ethiopia	1975	1991
1-197	Georgia	1993	1993
1-156 + 169	India	1988	2005
1-134 + 94	Indonesia	1975	1981
1-6 + 143	Iran	1979	1982
1-37	Israel	1982	1982
1-146	Liberia	2003	2003
1-135	Morocco	1979	1980
1-136	Mozambique	1981	1991
1-72	Nepal	2002	2005
1-140	Nicaragua	1978	1988
1-107	Nigeria	1967	1970
1-116 + 129	Pakistan	1971	1974
1-95	Peru	1983	1991
1-206	Russia (Soviet Union)	1995	2004
1-190 + 218	Serbia (Yugoslavia)	1991	1999
1-187	Sierra Leone	1995	1999
1-101	South Africa	1978	1988
1-164	South Yemen	1986	1986
1-117	Sri Lanka	1971	1971
1-200	Tajikistan	1992	1996
1-159	Turkey	1992	1999
1-118	Uganda	1981	2004
1-224	United States of America	2001	2001
1-122	Zimbabwe (Rhodesia)	1976	1979

Left column is conflict ID from PRIO database. Conflicts with multiple IDs are constructed conflicts.

Table A.3 – Conflicts in TH25 dataset			
PRIO ID	Country	Start of conflict	End of conflict
1-126	Bangladesh	1975	1991
1-194 + 202 + 203	Bosnia-Herzegovina	1992	1995
1-165	Burkina Faso	1987	1987
1-103	Cambodia (Kampuchea)	1967	1998
1-125	Chile	1973	1973
1-167 + 213	Comoros	1989	1997
1-214	Congo	1993	2002
1-195	Croatia	1992	1995
1-184	Djibouti	1991	1999
1-196	Egypt	1993	1998
1-120	El Salvador	1972	1991
1-130	Eritrea	1997	2003
1-149	Gambia	1981	1981
1-111	Guinea	2000	2001
1-216	Guinea-Bissau	1998	1999
1-186	Haiti	1989	2004
1-153	Kenya	1982	1982
1-217	Lesotho	1998	1998
1-146	Liberia	1980	2003
1-223	Macedonia, FYR	2001	2001
1-114	Madagascar (Malagasy)	1971	1971
1-253	Mauritania	1975	1978
1-205	Mexico	1994	1996
1-199	Moldova	1992	1992
1-115 + 135	Morocco	1971	1989
1-140	Nicaragua	1977	1990
1-121	Oman	1969	1975
1-172	Panama	1989	1989
1-174	Papua New Guinea	1990	1996
1-175	Rumania	1989	1989
1-145	Saudi Arabia	1979	1979
1-189 + 190 + 218	Serbia (Yugoslavia)	1991	1999
1-187	Sierra Leone	1991	2001
1-164	South Yemen	1986	1986
1-147	Spain	1978	1991
1-162	Suriname	1987	1987
1-163	Togo	1986	1986
1-183	Trinidad and Tobago	1990	1990
1-148	Tunisia	1980	1980
1-119	United Kingdom	1971	1998
1-123	Uruguay	1972	1972
1-221	Uzbekistan	1999	2004
1-122	Zimbabwe (Rhodesia)	1967	1979

Left column is conflict ID from PRIO database. Conflicts with multiple IDs are constructed conflicts.