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Economic Costs of Mass Violent Conflicts

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Final Report for the Small Arms Survey, Geneva, Switzerland

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Abstract

This paper provides a critical analysis of the possible methods, data sources and the existing results of the field of 'the economic costs of mass violent conflict' by identifying strengths and weaknesses of the existing literature.

The report evaluates content, methods, and data sources of the existing studies. Regarding the content, the studies offer a broad range of tested cause and impact variables. However, their selection of considered factors is quite sketchy, and a general theoretical underpinning is missing. This warrants above all a better understanding of the channels of indirect effects of the economic consequences of mass violent conflicts. Out of the combination of findings from the different studies we can hypothesize that investment, military expenditure, sectoral shifts, and institutions and policies are key channels. To consider the economic costs, aside from accounting, most studies rely on counterfactual regression analyses. Also with respect to the methodology, an evolutionary progress has not taken place in the literature. The most prominent data sets used are the COW and the UCDP/PRIO for conflicts and the Penn World Tables and the World Development Indicators for socioeconomic data.

Based on the critical survey of the literature we propose three models for estimating cross-country costs of mass violent conflict. These models differ by complexity, ranging from standard regression analysis to computable general equilibrium models. We also discuss other forms of violent conflicts and possibilities to analyze them by using the proposed models.

JEL classification: C01; E2; O11; Q34

Keywords: development economics, violence, conflict, war, macro-economics, econometrics, GDP, growth, reconstruction

Content

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Abbreviations

CGE	Computable General Equilibrium
COW	Correlates of War Project
DSGE	Dynamic Stochastic General Equilibrium
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	Generalized Methods of Moments
ICOR	Incremental-Capital-Output-Ratio
ICRG	International Country Risk Guide
ILPES	Instituto Latinoamericano de Planificacion Economico y Social
IV	Instrumental Variables
MWP	Marginal Willingness to Pay
OLS	Ordinary Least Squares
PWT	Penn World Tables
2SLS	2-Stage Least Squares
UCDP/PRIO	Uppsala Conflict Data Program/International Peace Research Institute, Oslo
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
WDI	World Development Indicators
WHO	World Health Organization
↑	Trend increasing
→	Trend constant
↓	Trend decreasing
~	No reliable trend

Executive Summary

This report sets out to evaluate the state of the art of computing the costs of mass violent conflicts on a global level. Current studies estimate costs of conflicts both for single countries and for pools of countries (cross-country studies). We evaluate both types of approaches with the aim of developing a consistent model of estimating costs, which addresses the solved and unsolved challenges encountered in the existing literature.

This report starts with an overview of the entire literature, as a necessary step towards understanding the challenges and formulating recommendations, both in terms of research directions and in terms of policy implications. The specialized literature suggests that effects manifest themselves on different levels, from individual households, to markets and the macroeconomic aggregate. While this latter distinction holds true, all current studies indicate that the effects of conflict are overwhelmingly negative. Such stark results are not devoid of problems. First, concerning single country studies the major problem is the lack of a comparable and consistent framework across studies, including possibly inconsistencies within studies caused by duplications in the counting of costs and dependence on strong assumptions. Second, the other strand of the literature comprising cross-country studies fails to take full account of state of the art econometric techniques and does not sufficiently integrate dynamics and typology of conflicts. Additionally, these studies often fail to model more than one of the various effects of conflict that we would expect based on the earlier conceptual works.

Section 3 of the report analyzes the content-related shortcomings in depth. It is highlighted that the literature has produced results on a variety of channels. It seems clear that different forms of capital matter for development and are strongly affected by conflict: both human and physical capital formation processes are severely affected. Additionally, international trade and financial capital flows are disrupted. Conflict characteristics matter and conflicts have effects after the onset of peace, and thus this heterogeneity should be integrated into most studies. Additional factors include institutions and national as well as international policies. National policies include social policies, while international policies refer to post-conflict development aid and peacekeeping missions. Several of these effects suggest international spillovers between countries. However, not all of these effects are well-established and further research is warranted in some respects. In addition to this, micro-level studies based on surveys collecting qualitative and quantitative information on livelihood can provide insights into channels of conflicts which cannot be analyzed on basis of macroeconomic indicators alone. These include social capital, individual coping strategies, financial development, migration and markers of transaction costs. Another benefit of micro-level studies is that they can provide insights even when there are constraints in the availability of aggregate data.

While section 3 focuses on the content of studies, section 4 presents a technical framework for assessing the methodology used in cross-country studies. It is shown that under reasonable

assumptions the models used widely in the literature fail to establish a causal effect of conflicts on development. The reasons include an inflexible way of addressing dynamic effects of conflicts, important unobserved or omitted factors between countries, low development leading to conflicts and ignored information in missing data. Going beyond regression analysis, computable models of consumer decision making and of entire economies are discussed as ways to aggregate various effects of conflicts into a single measure of social welfare. While this may seem as a powerful tool, also the caveats are highlighted. These include questionable functional form assumptions and other simplifying assumptions.

Section 5 evaluates existing data sources for the computation of world-wide costs of conflict. Major databases of conflict and economic indicators, their data quality and data availability are discussed. Several problems of data quality are pointed out, such as inconsistencies between different conflict databases and problems of income as a welfare measure, which might be exacerbated during conflicts.

Based on the preceding criticism, section 6 derives possible ways of assessing the costs of conflict and derives also implications for future policy. This framework is also flexible enough to introduce the costs of other types of variables, provided there is reliable data. As a baseline model we propose modifying the standard regression analysis used in most studies to address the methodological concerns analyzed in section 4 and to include a richer set of conflict characteristics and dynamic effects. Possible extensions are proposed: Either including the main macroeconomic channels in a regression model or using a model that explicitly measures welfare rather than surrogates represents an intermediate level of complexity. Combining both approaches and including additional micro-level studies would allow identifying stylized facts which might allow in the building of a model of the world economy to assess global welfare costs including international spillovers. This would require additional efforts towards identifying indicators of welfare in affected populations going beyond health markers. Independently of which position is chosen, one policy implication derives directly from either proposal: If it is politically warranted to assess costs of conflicts, a public international organization must also ensure the regular assessments of welfare indicators in the afflicted population, instead of relying on scattered datasets. Another policy implication is that computing costs alone is not satisfactory: understanding the channels through which conflict affects welfare is a step required to derive implications for the work of development initiatives in post-conflict situations at the country as well as the household level.

1 Introduction

'We will spare no effort to free our fellow men, women and children from the abject and dehumanizing conditions of extreme poverty, to which more than a billion of them are currently subjected. […] We resolve […] to halve, by the year 2015, the proportion of the world's people whose income is less than one dollar a day and the proportion of people who suffer from hunger and, by the same date, to halve the proportion of people who are unable to reach or to afford safe drinking water.'
(United Nations Millennium Declaration, adopted by the General Assembly on 8 September 2000)

'The international community has acknowledged that armed violence and conflict impede realization of the Millennium Development Goals, and that conflict prevention and resolution, violence reduction, human rights, good governance and peace-building are key steps towards reducing poverty, promoting economic growth and improving people's lives.'
(Geneva Declaration on Armed Violence and Development, 7 June 2006)

One third of the world's population is living in conflict-affected low-income countries, and two thirds of them are living in rural areas (*own calculations*). These numbers, together with the above quoted statements of the international community, point strikingly at a central challenge for human development. The end of the Cold War led to hopes of a rapid end of violent conflicts, but unfortunately reality proved otherwise. The project "Global Burden of Armed Violence Report" analyzes the link between violence and hindered development, and so do we. Specifically, we explore a way to calculate differentiated world-wide economic costs of mass violent conflicts on a comparable basis.

Violence and conflicts are manifold. We define mass violent conflicts as the systematic breakdowns of the social contract resulting from and/or leading to changes in social norms, which involve mass violence instigated through collective action. Economic costs are one aspect of the resulting hindered development. We consider them as all short- and long-term measurable costs resulting from a mass violent conflict, convertible to welfare losses, and gathered by accounting and/or counterfactual calculations.

The paper will provide a critical analysis of the field of 'the economic costs of mass violent conflicts' including possible methods, data sources, and existing results. It identifies strengths and weaknesses of existing studies and will use these findings to discuss the possibility of a unified framework to calculate the costs of mass violent conflicts at the global, regional, and country-level.

We therefore focus on GDP-related issues, either in absolute terms or in relative terms, i.e. GDP-growth. Thus we consider the *overall income of countries in conflict*. However, we have

to take care on several challenges: international spill-over effects (Murdoch/Sandler 2004) as well as long-lasting consequences (Arunatilake et. al., 2001) are not considered in the single GDP-value of a given war-year and have to be treated separately. Another problem are activities which should be included in the GDP-measures theoretically but are not in official statistics, chiefly the production of value in the informal economy. For an in depth discussion of the 'GDP-informal economy'-debate compare section 5.2.3. In addition to this, GDP values may not encompass completely concepts such as welfare or development. First, GDP does only measure monetary transactions, not including activities that people value, like leisure. Second, the distributional aspects (poverty, inequality, polarization) are not necessarily part of the indicator.

Next to these handling-problems with GDP, we encompass the problem, that for a differentiated insight into the dynamics of economic costs of mass violent conflicts we may wish to gain disaggregate information, like public and private consumption, investment, and inequality-patterns etc., which are not observable directly from GDP measures. Here, additional insights can just be generated through disaggregate data collection.

Considering this, the framework not only highlights the comprehensive economic costs of mass violent conflicts, but it also gives insights into channels through which these costs realize themselves. Consequently, it is possible to estimate the benefit of conflict prevention, and it furthermore provides substantial knowledge on how to promote prospective policies.

This framework circumscribes what our project can offer, but it also gives hints on what we will not provide without denying its relevance. The most obvious object is the personal suffering from violence, which cannot be accurately quantified. We have to exclude effects of lower levels of conflicts, as these cannot be reliably calculated on a global level from macroeconomic data, although we try to integrate as many aspects as possible. Terrorism is included only if used as a combat tactic in mass violent conflicts. And we focus on the consequences of physical violence. Nonetheless, this does not deny structural violence, which has to be included in a broad discussion of human development. Further discussions of included and excluded challenges for our project can be found in sections three, six and seven.

To reach this point, we start with a structured overview of the state of the art. We outline the development of the debate on the economic consequences of conflict. A literature review on the central works of the last twenty years follows, categorized along characteristics of scale.

We conclude this section by analyzing three conflict-torn countries based on single-country-studies, followed by a discussion of four key cross-country studies. Sections three to five evaluate insights that were identified in section two, clustered by content, methodology and data. Section six frames the way forward. We develop a unified concept of analysis and discuss its operational components. Additionally we address other forms of mass violent conflicts. In a further part we discuss policy implications and finally we outline a workflow for future research. The paper will be concluded by a short summery.

2 State of the Art

This section surveys the literature concerning our research question. Most studies concerning mass violent conflicts do tread economic costs somehow (e.g. Carnegie 1997: 18-22). However, far fewer studies do analyze the economic costs in a more focused, differentiated, and consistent way. In addition to the works on the key debate between economics and political science, we include helpful literature from neighboring debates and disciplines. There are two aims of this section. On the one hand, we provide a comprehensive insight into previous works to facilitate the understanding of the debate. On the other hand, this section summarizes the theoretical, methodological, and empirical material for our analyses in sections three to five.

2.1 Debates

The interrelationship between mass violent conflicts and the economy is not new and neither is the scientific debate about it. We can identify three main discussion lines. One strand of the literature analyses the relation between the economy and the onset of mass violent conflicts. This debate includes such diverse analyses as Machiavelli's 'Principe' (1532), Lenin's 'Imperialism' (1916), Galtung's 'Structural violence' (1969) to Collier and Hoeffler's 'Greed vs. Grievance' (2004). Secondly, the economy – and more narrowly the resulting revenue system – was a central point of concern for the ability to conduct a mass violent conflict, treated for example by Clausewitz (1812) and consequent professionals on military economy and logistics. And thirdly, out of this discussion emerged a debate on the economic consequences of military expenditure (Smith 1989; Sandler/Hartley 1995; Dunne/Perlo-Freeman 2003). This discussion does not just focus on 'hot conflicts', but regards effects of

military expenditure in peace times additionally, while not facing topics of damage and destruction.

2.1.1 The economic consequences of interstate wars

Meanwhile, the analysis of the consequences of mass violence for the economy during and after its occurrence is a rather neglected field. We can find a first literary treatment of the subject in Berthold Brecht's 'Mother Courage' (1939) and on a scientific base John Maynard Keynes 'The economic consequences of peace' (1919).

One line of argument is based on Sombart's notion of 'creative destruction' (1913), or more glamorously the 'Phoenix Factor' (Organski/Kugler 1977). The argument is that the destruction and/or alteration of development hindering structures can release energies that give rise to an onset of development as a result of the war. These structures can encompass (van Raemdonck/ Diehl 1989):

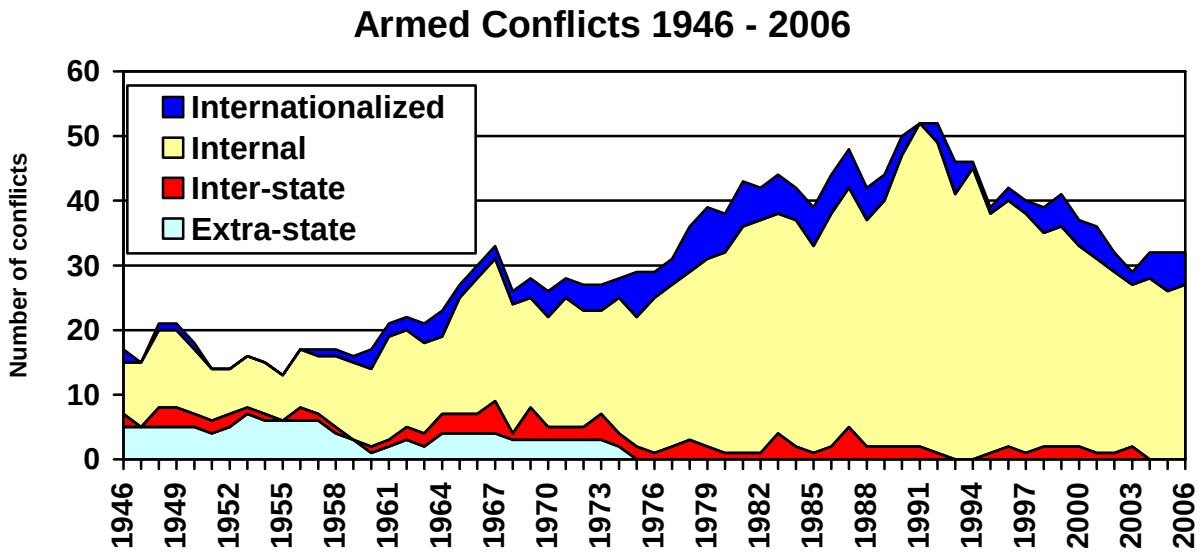
- **state control** and protection of national industries,
- **replacement** of obsolescent industrial equipment with more efficient infrastructure and the destruction of growth hindering 'distribution coalitions' (interest groups, political alliances, etc.), and
- war **research** spin-offs, including the exploration of new sources of raw materials or ready substitutes and the development of managerial and organizational skills.

This debate focuses primarily on inter-state wars and considers as empirical cases the development of countries during and after WWI and WWII. More skeptic research on the consequences of war points at:

- the inefficient **state influence** on the economy,
- the **destruction** of infrastructure and therefore the destruction of capital, as well as the killings of people, thus the destruction of human capital,
- the **distraction** of assets to the non-productive military sector, and
- increased **debt** and therefore missing investment capital.

2.1.2 Intrastate wars

Figure 2-1
Armed Conflicts in the previous 60 years



Source: UCDP/PRIO, own calculations

These negative impacts of mass violent conflicts gained still more importance as the debate shifted from interstate wars to internal armed conflicts[1]. As Figure 2–1 shows, the share of interstate wars after WWII is low. However, for our project, contemporary conflicts are the main focus. Figure 2–2, which shows conflicts and post-conflict situations in 2006, confirms the insights from Figure 2–1: there was no interstate war occurring in 2006, while there were 26 ongoing internal armed conflicts (either isolated or with international intervention) on intensity levels II and III[2]. Therefore, the 'Phoenix Factor' proclaimed by the war specialists of the last century has at least to be re-evaluated for internal wars – and most recent research would say, rejected completely. Nonetheless, it gives a hint, that the economic consequences and even the economic costs of mass violent conflicts are manifold and diverse – more on that in section three and six.

[1] As mentioned above, these internal armed conflicts do include terrorist attacks as well, as long as they are regarded as part of a mass violent conflict.

[2] The UDCP/PRIO Dataset does use three levels of intensity to codify armed conflicts:

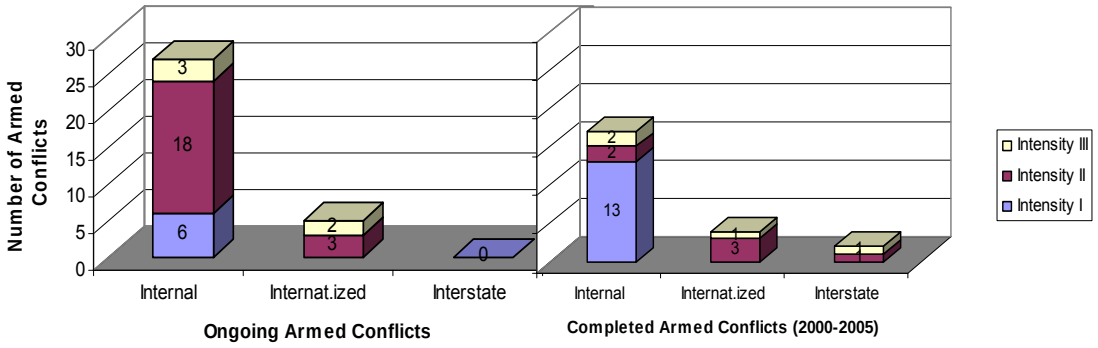
I: 25-999 battle deaths in the current year; less than 1000 battle deaths during the whole conflict

II: 25-999 battle deaths in the current year; more than 1000 battle deaths during the whole conflict

III: more than 1000 battle deaths in the current year

FitzGerald's analysis (1987) on the costs of the US-backed destabilization of Nicaragua by the rightwing Contras can be considered the first contemporary analysis of the economic costs of mass violent conflicts. After the dissolution of the Warsaw Pact and the persistence of mass violent conflicts throughout the world, for example in Somalia and Rwanda, mass violent conflicts other than interstate wars became the focus of public and scientific attention. Following FitzGerald, different single-country studies have been conducted. First attempts to explore generalized insights along cross-country studies proceeded. We will consider this contemporary debate in detail.

Figure 2-2
Ongoing and recently completed armed conflicts in 2006;



Source: UCDP/PRIO, own calculations;

2.2 Single & Cross-Country Studies

2.2.1 Categorization along the scope of cases

There are different possibilities to differentiate this debate. As it is still in its infancy, a categorization along topics of analysis is not helpful, as most of the studies share some key features on the one hand and differentiate their scope on a whole range of additional variables on the other side (cp. section three).

A second possibility would be to differentiate along methods of calculating the costs of mass violent conflicts (cp. Lindgren 2006). This seems to be quite fruitful. In theory we can distinguish accounting methods and counterfactual methods, which are done in the subsequent parts of the paper. However, the different studies show that *any* calculation relies on some

counterfactual estimation. This is the consequence of the evident analysis that any serious calculation of costs of conflict cannot just consider destroyed or damaged assets, but has to include the consequent costs as well.

Therefore we will categorize the studies along their scope: cross-country-studies vs. single-country studies[3]. While single-country studies try to account and estimate costs for a certain conflict-torn area, cross-country studies try to generate generalized insights. As a third strand, we consider more conceptual works, which structure the debate.

2.2.2 Literature

2.2.2.1 Conceptual works

Although any study does include some conceptual work we base our paper on three key works, which highlight different aspects of the question in concern. These conceptual works are generally broader than our research question and focus not only on the economic costs but on economic development in general. However, they are a good starting point.

Van Raemdonck and Diehl (1989) focus on the mentioned debate about the phoenix factor in post-war societies. As results from reviewed studies are ambiguous, they call on the one hand for broader empirical studies, and on the other hand for disaggregating macroeconomic indicators. They also ask for a differentiation along characteristics of conflicts. Finally, they highlight the importance of reconstruction-policies and the need to further investigate its possibilities and constraints.

A second work from a political economy perspective is 'War and Underdevelopment', edited by Stewart and FitzGerald (2001)[4]. It is the first comprehensive account of the relationship between war and hindered economic development in non-OECD countries. They, too, consider different structural characteristics as influential to the economic consequences of mass violent conflicts. On the conflict side they differentiate conflicts along

a) the duration of war,

b) the geographic spread, and

[3] Note that for now we do not speak of 'cases' as the question on the 'case' can be ambiguous, e.g. regarding conflicts as our cases, Sri Lanka has two cases, the Tamil Tiger rebellion as well as the Janatha Vimukthi Peramuna (Peoples' Liberation Front) rebellion. But as long as we do not consider sub-regional numbers, calculations on GDP and fiscal consequences are state-wide. For example, all single-country studies on Sri Lanka do calculate comprehensive state-wide costs.

[4] The first volume does combine different conceptual works, while the second volume includes single-country studies.

c) the foreign involvement.

On the economic side they consider as important

d) the average level of income,

e) the share of the agricultural subsistence sector,

f) the foreign-exchange-significance, and

g) the flexibility of the economic system.

They differentiate the economic consequences of mass violent conflict along

I. direct impacts, which encompass the losses due to destroyed assets and its consequences, and

II. the consequences of altered behavior of economic agents.

Finally, they point at the different levels of society, where mass violent conflicts have an impact:

(1) the macroeconomic level,

(2) the mesoeconomic level (economic sectors, government expenditure allocation, etc.) and

(3) the microeconomic (or household) level (cp. Humphrey/Stewart 1997).

The last level is the central focus in Justino's work (2006) on the 'links between violent conflict and chronic poverty'. She divides her analysis on impacts along topics:

I. monetary aspects of poverty,

II. education and literacy,

III. health and nutrition, and

IV. migration and displacement.

At the end she calls for differentiated micro-economic analysis as well as for a more fruitful collaboration of micro- and macro-economic analyses. These methodological challenges result from missing empirical insights into

a) coping strategies of households,

b) (labor market and employment) policies, and

c) effects of outside intervention (peace-building, aid, etc.).

These topics fit to Stewart's and FitzGerald's level-categorization.

2.2.2.2 Cross-Country Studies

Cross-country studies followed as well as preceded the conceptual works. General accounts on the consequences of civil wars can be found in the growth literature. Easterly et al. (1993) estimate growth regressions from 1960-1988, using pooled Ordinary Least Squares (OLS) with time fixed effects and find a direct negative effect on growth for the 1970s and additional indirect effects via economic policy. Barro and Lee (1994) did not find significant effects in their regression analysis for war dummies. Sala-i-Martin (1997) on the other hand found a robust negative effect of war in his modified extreme bounds analysis.

A first conflict-focused attempt of a cross-country study has been conducted by Stewart and Humphrey (1997) as part of a special issue of the 'Oxford Development Studies'. Using descriptive statistical analyses they provide generalized trends in different economic cost-relevant indicators with the following results: GDP growth (↓), food production (↓), savings (↓), exports (↓), government revenue as GDP-percentage (~), debt (↑), industrial shares (↓), health (↓), and education (↓).

Two years later, Collier (1999) followed with a regression analysis on GDP growth, which will be evaluated in detail in section 2.4.1. He finds a general decline of economic growth during armed conflicts which can exceed into the peace period, when the conflict was short. Imai and Weinstein (2000) took Collier as their base to further the analysis by differentiating conflicts along their geographical spread, using a scale from 0 to 5 (no conflict to 'more than half of the country affected'). They show that the geographical spread has an impact on the quantity of the negative growth effect and that domestic investments are a central channel.

Stewart, Huang, and Wang (2001) tried to differentiate economic consequences, but could just use descriptive statistical analyses to capture changes. To estimate comprehensive economic losses, they calculated counterfactuals along regional average GDP-growth rates of non-conflict-affected countries. They differentiate and confirm the findings from Humphrey and Stewart (1997). Hess (2003) turned again to regression analysis, but switched to a welfare-measure, based on consumption growth (cp. 2.4). He finds that people around the world would be willing to sacrifice a substantial part of their income for a peaceful world.

The following three studies expand to the effects on health. Ghobarah et al. (2003) use a WHO-survey from 1999 to analyze consequences of wars during 1991-1997 on life expectancy. The authors disaggregate social groups along their age and sex and find significant differences. In the second part of the study, they further differentiate the

considered effects along different kind of diseases. Civil Wars have significant impacts on a wide range of health topics, above all on infectious diseases like malaria, tuberculosis and HIV/AIDS. Hoeffler and Reynal-Querol (2003) start with a descriptive statistical of a wide range of effects (income ↓, refugees ↑, military expenditure ↑, capital flight ↑, policy measures ↓, diseases ↑, HIV-rates ↑, psychological legacies ↑, landmines ↑, etc.) and continue with a regression analysis of growth (↓) and infant mortality (↓). Guha-Sapir/van Panhuis (2004) again narrow their analysis to mortality and differentiate young children under five from others. Older children are more affected by armed conflicts. However, as acknowledged by the authors, their data quality for the descriptive statistical analysis is ambiguous.

Gupta et. al. (2004) focus on more conventional economic measures (inflation ↑; debt ↑; health/education →), but differentiate their regression analyses and use a different data set (again cp. part 2.4.2). Murdoch and Sandler (2004) enrich the literature on the economic costs of mass violent conflict by considering the effects of war on neighboring countries. According to their results, this effect is significant, but independent of the length of conflicts. Kang and Meernik (2005) focus on post-war growth, differentiate war along its severity, and consider some new influences like UN-operations (↑), opposition/government victory (↑), and aid (~). Additionally they control for the endogenous characteristics of civil war. Koubi (2005) differentiates types of war with a regression analysis to capture the long-term post-war development, without contributing new insights.

Chen et al. (2007) focus on the aftermath of civil war, using an 'event-study' methodology. They compare pre- and post-conflict situations and find a devastating effect of civil wars on various indicators of development. In the second part, they focus on the dynamics of post-conflict development and find a 'U'-trend regarding post-war growth development: an increasing growth rate in the immediate aftermath drops back after a while. Finally Lai and Thyne (2007) evaluate the effects of wars on education, differentiated by levels of education and sex. Overall, a decline of education expenditure and school enrolment caused by the severity of the armed conflict can be shown, however not because of higher military expenditure. Males are most affected regarding secondary school enrolment.

2.2.2.3 Single Country Studies

Calculating the economic costs of conflict would be a task for every conflict. Nonetheless, research has focused on just a few countries – with Sri Lanka as the absolute favorite. Results of the single studies will be shown in the next chapter.

The first calculation was FitzGerald's analysis on Nicaragua (1987), based on a study of war damages by the government of Nicaragua for presentation before the International Court of Justice at the Hague. The author mixed accounting methods with counterfactual analyses, based on projections of the government and international organizations. At the beginning of the 1990s, two works on Sri Lanka followed. Richardson and Samarasinghe (1991) combined accounting methods with counterfactual methods, based on time series interpolation of pre-war development. Grobar and Gnanaselvam (1993) based their counterfactual analysis on a growth model and the economic costs of additional military spending, related to the civil war. In 1997, DiAddario turned again to Nicaragua. She replicated a UN-study, based on a Keynesian model, and advanced it by considering 'structural breaks', i.e. changes in the behavior of economic agents. Harris published two papers on Sri Lanka (1997, 1999). He bases his regression analysis on a model which emphasizes the shift of governmental expenditure to military consumption, and the consequential missing of investment capital. In the same year Brown and Rosecrance (1999) published an edited book, which contains several case studies comparing costs of external intervention and prevention. Unfortunately, they did not invest effort on counterfactuals, but have based their numbers mostly on accounting. Kelegama (1999) adopted a mixed approach for Sri Lanka. He builds on Grobar and Gnanaselvam's 1993 model of military expenditure and adds accounted values of destroyed assets plus a counterfactual estimation of tourism losses, based on projections. He repeats this study together with Arunatilake and Jayasuriya in 2001, again using a mixed approach. This time they use a more complex model for the regression analysis. The above mentioned edited book from Stewart and FitzGerald (2001) contains in their second volume a number of country studies, focusing on the overall economic development with different amount of space reserved for the economic costs. Mostly descriptive statistical analyses are used. Finally, six studies explicitly focusing on the economic costs of mass violent conflicts in different countries followed: Dorsey and Opeitum (2002) conduct a study on Northern Uganda, based on a mixed approach of accounted and estimated losses, done by consultants.

Nordhaus (2002) provides both accounting and estimates using a somewhat more sophisticated methodology to capture the costs of the war in Iraq. In his "putty-clay" models the capital intensity is fixed in the short run and flexible in the long-run, unlike the studies above. This allows him to separate long-run productivity effects and short-run business cycle effects. His ball-park is up to 2 trillion US$, similar to Bilmes and Stiglitz (2006).

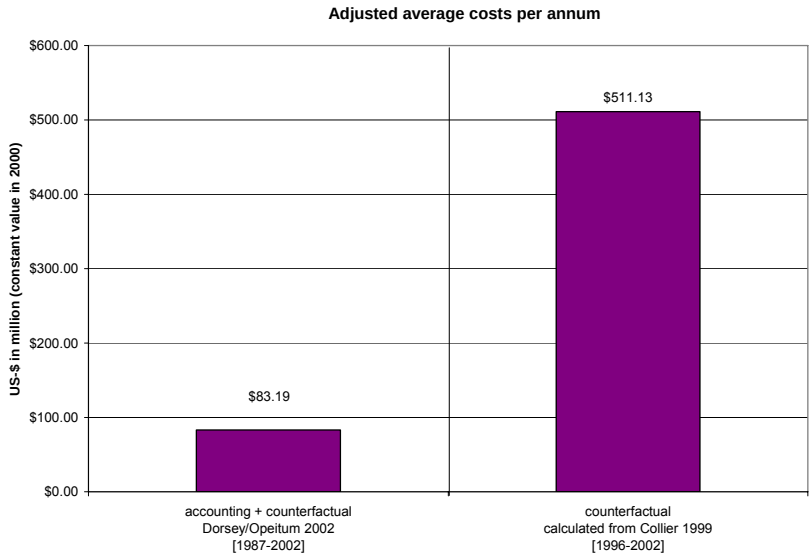
Abadie and Gardeazabal (2003) analyze the economic costs of the mass violent conflict in the Basque Country in a counterfactual analysis by comparing the real development with a 'synthetic Basque Country', a weighted mean of other Spanish regions. They additionally check their results using a 'placebo study' and finally conduct an event study, based on the comparative survey of returns of companies (not) active in the Basque country at the Spanish stock exchange. They find a negative effect of the conflict on the Basque economic growth, but no spill-over effect on other Spanish regions. The next study regards the impact of Rwanda's genocide in 1994. Lopez and Wodon (2005) use statistical methods for outlier identification to capture the economic losses along time series of GDP and GDP-growth and find a GDP-reduction for 1994, but no long-term consequences for the growth rates. Bilmes and Stiglitz (2006), using different methods including a global general equilibrium model, find for Iraq high budgetary costs and additionally cost out of increased security and higher oil prices. Finally, the UNDP (United Nations Development Program) conducted a study on the consequences of mass violence in Guatemala (Balsells Conde 2006), which shows economic costs for low-intensity violence.

2.3 Selected Single-Country Studies in Detail

Using these studies, we can compare studies in detail for three conflict-ridden countries. The selection is based on the availability of studies and the attempt to offer studies for different regions. Additional to the country studies, we calculated costs based on the estimates of a cross-country study (Collier 1999; cp. section 2.4.1). These calculated values are rough estimates for demonstrative purposes only.

2.3.1 Uganda

Figure 2-3
Adjusted average costs per annum



Source: own calculations

2.3.1.1 Conflict & Studies

For two decades, the Lord's Resistance Army and its predecessors have challenged the government in the northern areas of Uganda. In 2002 the Civil Society Organizations for Peace in Northern Uganda commissioned a comprehensive study on 'The Net Economic Costs of the Conflict in the Acholiland Sub-Region of Uganda', prepared by Dorsey and Opeitum (2002).

2.3.1.2 Methodology

The study combines accounting methods with counterfactual estimates, done by external consultants. In the published study, there are only scarce accounts on the methodology of these estimations. From the paper, we can conclude that mostly sample and time-series data where used, augmented by some expert estimates on structural changes.

2.3.1.3 Data

The study uses a wide range of data sources, considering the impact of the war on the northern part of the country. The authors established a network of data gathering with the possibility of cross-checks. Governmental and administration information from different

levels (national, local) have been used to estimate destruction costs and war-related military expenditure. Production data has been provided by international organizations like the World Bank, as well as by private organizations like British American Tobacco and the Cotton Development Organization. Where local data was missing, the study projects data from war-free regions to the war-ridden regions.

2.3.1.4 Results

The study estimates that the economic costs of the war in Northern Uganda accounted for about 1.3 billion US$. As the three biggest channels, the study identifies

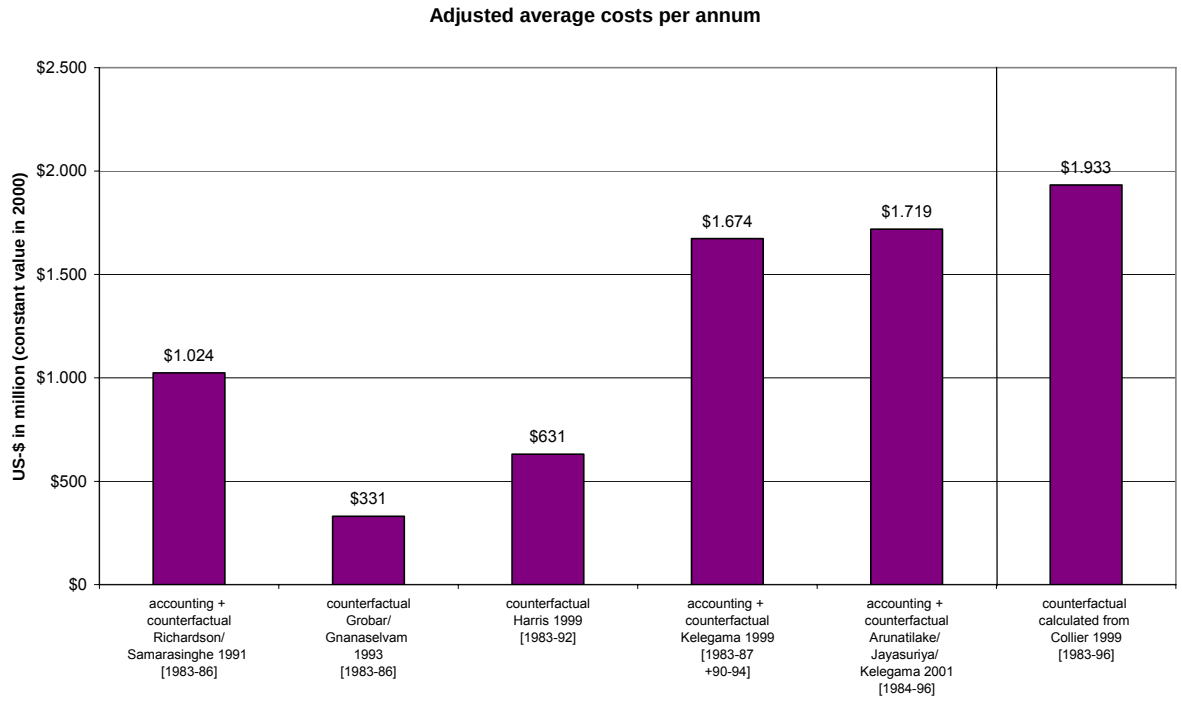
- direct military expenditure (27.58%),
- loss of income from crops (15.96%), and
- reduction in tourism (13.9%).

If we consider cross-country data, the calculation is significantly different. A crude estimation based on the estimates by Collier (1999) leads to a total cost of 3.58 billion US$, just calculated for the years 1996-2002[5].

[5] The COW-Dataset used by Collier does not identify a conflict between the LRA and the government until 1996. An additional conflict between the National Resistance Army and the government can be found from 1980-1988. On the other hand, the UDCP/PRIO-data set does code just a single escalated conflict between the government and various opposition groups from 1979 onwards.

2.3.2 Sri Lanka

Figure 2-4
Adjusted average costs per annum



Source: own calculations

2.3.2.1 Conflict & Studies

The island on the southern tip of India has been ridden by mass violent conflicts since the 1980s. Additional to the well-known conflict between the government and the Tamil Tigers, a mass violent conflict between the government and the Janatha Vimukthi Peramuna (Peoples' Liberation Front) also occurred throughout this time period, on high intensity levels from 1988-1989. Five studies on the economic costs of these conflicts were conducted during the last fifteen years.

2.3.2.2 Methodology

Three of these studies use a mixed methodological framework, while two studies constrain themselves to GDP-estimations based on an economic model.

Grobar and Gnanaselvam (1993) develop their model on the hypothesis that missing investment because of higher military expenditure hinders economic development. Using a time series, they estimate coefficients for the impact of military expenditure on the investment

rate. This coefficient is multiplied with the military expenditure increase during the war and finally multiplied with an incremental-capital-output-ratio (ICOR) to measure the (negative) GDP-growth-effect of lost capital investment. The authors calculate this ratio as the average of this coefficient during the last decade of peacetime.

Harris (1997) focuses on savings and its impacts as well. From survey data prior to and a decade after the onset of the conflict, he gathers consumption rates and compares an ideal consumption with the real consumption at the end, subtracts them from GDP to get the savings, and multiplies the savings with a chosen ICOR (cp. previous paragraph).

The other three studies take more time to categorize costs and estimate additional costs from them. Richardson and Samarasinghe (1991) account destruction of physical infrastructure, costs for providing help to refugees, costs of migration (travel tickets) and capital migrants took overseas and estimate costs on foregone development by a counterfactual analysis using projections of pre-conflict trends.

Kelegama (1999) calculates the costs of forgone investment and production opportunities based on military expenditure as calculated by Grobar and Gnanaselvam (1993). As secondary costs he considers temporary losses in production and tourism because of destruction and insecurity, calculating the service value of destroyed assets as well as projection tourism data from previous development. As tertiary costs he considers rehabilitation cost of displaced persons, from which he just accounts relief assistance.

Finally, Arunatilake, Jayasuriya and Kelegama (2001) account direct costs like war-related expenditure and add estimations using time series regressions based on a differentiated foregone-investment model. Contrary to Grobar and Gnanaselvam (1993) and Kelegama (1999) they recalculate ICOR for every year via a regression analysis. A further time series regression has been calculated on tourism losses; foregone foreign investment was estimated on previous investment trends. Lost lives and injuries are calculated as forgone labor force, calculated from average unskilled labor wages multiplied by expected working-life expectancy.

2.3.2.3 Data

The studies base their calculations on data provided by the administration, the Sri Lankan National Bank, and international organizations like the World Bank.

2.3.2.4 Results

Table 2-1
Calculated Costs of the armed conflict in Sri Lanka

Costs in billion US$ (constant value in 2000)	Richardson/ Samarasinghe 1991	Grobar/ Gnanaselvam (1993)	Harris (1999)	Kelegama (1999)	Arunatilake/ Jayasuriya/ Kelegama (2001)
War Years	1983-86	1983-86	1983-92	1983-87+ 1990-94	
Total Costs	6.15b US$	1.99b US$	6.31b US$	16.74b US$	22.34b US$
Average per annum	1.02b US$	0.33b US$	0.63b US$	1.72b US$	1.93b US

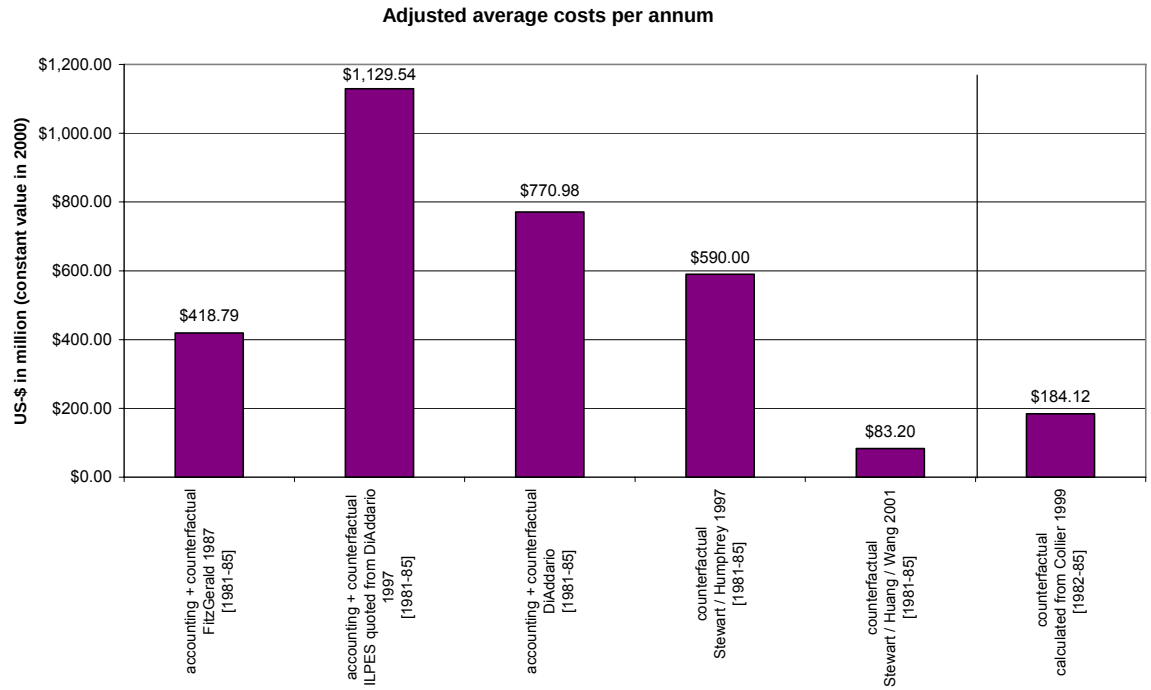
Source: own calculations

As the data show, there is no generally accepted number of economic costs of the mass violent conflicts in Sri Lanka. On the contrary, the average costs per annum vary by a multiple of six. Where disaggregate data is available, it is remarkable that foregone development costs are central. A comparison of the different studies along their disaggregated data is difficult as there is no coherent framework of analysis. The most recent study (Arunatilake et. al., 2001) provides the following table:

- 42.4% lost earnings due to lost foreign investment
- 27% direct losses because of military expenditure consumption
- 10% lost income from reduced tourist arrivals
- 8% costs of lost infrastructure
- 5.1% lost income due to foregone public investment
- 9.8% others (relief services, displacement, etc.)

2.3.3 Nicaragua

Figure 2-5
Adjusted average costs per annum



Source: own calculations

2.3.3.1 Conflict & Studies

After a leftist government took power in Nicaragua, a rightwing insurgency erupted in 1980, backed by the United States. This case was brought in front of the International Court of Justice, for which a study to estimate the economic consequences of the war has been done by the United Nations' Instituto Latinoamericano de Planificacion Economico y Social (ILPES). A second study, done by the Government of Nicaragua, is the base of a paper by FitzGerald, published in 1987. Ten years later, DiAddario replicated the ILPES study and refined it along their theoretical base and consequently along the econometric model. To compare we add data from two cross-country studies (Stewart/Humphreys 1997; Stewart/Huang/Wang 2001).

2.3.3.2 Methodology

FitzGerald (1987) uses time series projections to estimate the overall costs of conflict. The same methodology he uses for the estimation of disaggregated data like the cost consequences of the U.S. embargo or the government military expenditure. The ILPES study (quoted from

DiAddario 1997) calculates a counterfactual GDP via an econometric model: a regression analysis calculates "Keynesian" multiplier effects on two constraints:

(i) saving constraints (calculated as the loss of material damage to capital stock from direct military attack)

(ii) foreign exchange constraints (US trade embargo)

DiAddario includes in her model 'structural breaks', i.e. changes in the behavior of economic agents (shifts in their marginal propensity to import and their marginal propensity to consume). The two cross-country studies base their counterfactuals on comparison with the average regional development of peace countries.

2.3.3.3 Data

The data used were provided by the Nicaraguan Government as well as by international organizations (World Bank and a survey by the United Nations).

2.3.3.4 Results

Table 2-2
Calculated Costs of the armed conflict in Sri Lanka

Costs and billion US$ (constant value in 2000)	FitzGerald 1987	ILPES 1988 (quoted from DiAddario 1997)	DiAddario 1997	Stewart / Humphreys 1997	Stewart / Huang / Wang 2001
War Years	1981-85	1981-85	1981-85	1981-85	1981-85
Total Costs	2.09b US$	5.65b US$	3.85b US$	2.94b US$	0.42b US$
Average per annum	0.42b US$	1.13b US$	0.77b US$	0.59b US$	0.08b US$

Source: own calculations

Here too, the studies differ substantially along their estimated costs. This is most obvious in DiAddario's paper, which highlights the key influence of the econometric model for the calculation outcome and leads in this case to an overestimation – taking DiAddario's refined model as basis – of the ILPES model of 46.8%. FitzGerald disaggregates data and concludes that primary sector and secondary sector are losing around 10%. Further key negative effects are the decrease of export revenues (as much as -30%), an augmentation of the fiscal deficit (5 percentage points of the GDP on average) and a higher inflation rate (13 percentage points).

2.3.4 Summary

The following summary table gives an overview on methodology and key issues of the single country studies. Every conflict-related study which tangles the economy will try to provide some statistical indicators, which normally are based on simple comparisons between pre- and post-war situations. However, the following studies are prominent in their understanding of economic costs on a macro-economic level of single countries ridden by conflict and are therefore central for the scientific evolution of knowledge.

Table 2-3
Overview on single country studies

Author(s), Year	Country	Methodology	Key Issue
FitzGerald 1987	Nicaragua	Accounting + Counterfactual Analysis (Projections)	Import/Export-Structures
ILPES quoted from DiAddario 1997	Nicaragua	Counterfactual Analysis (Regression for Multipliers)	Consumption and Saving Constraints;
Richardson/ Samarasinghe 1991	Sri Lanka	Accounting + Counterfactual (Regression Analysis)	Categorization of Costs: direct + indirect costs + policy consequences
Grobar/ Gnanaselvam 1993	Sri Lanka	Counterfactual (Regression Analysis)	Military Expenditure and distorted investment
DiAddario 1997	Nicaragua	Counterfactual Analysis (Regression for Multipliers)	Consumption and Saving Constraints; Structural Breaks
Harris 1997/1999	Sri Lanka	Counterfactual (Modelling on investment-assumptions)	Missing savings because of higher MILEX = missing investment
Brown/ Rosecrance (eds.) 1999	Bosnia, Rwanda, Somalia, Haiti, Persian Gulf, Macedonia, Slovakia, Cambodia, El Salvador	Accounting + some pre-post-war comparisons	Military, humanitarian, other direct economic costs
Kelegama 1999	Sri Lanka	Accounting + Counterfactual (Projections)	MILEX + destruction + tourism
Arunatilake/ Jayasuriya/ Kelegama 2001	Sri Lanka	Accounting + Counterfactual (Regression)	MILEX + investment + tourism + human capital + displacement
Stewart/ FitzGerald (eds.) 2001	Afghanistan, Mozambique, Nicaragua, Sierra Leone, Sri Lanka, Sudan, Uganda	Time series analyses (descriptive statistics + some regressions)	GDP + disaggregate data
Nordhaus 2002	Iraq	Accounting + Counterfactual Analysis ("putty-clay" models)	includes post-war reconstruction costs; oil markets
Dorsey/ Opeitum 2002	Uganda	Accounting + Counterfactual Analysis (Projections)	broad range of disaggregate data
Abadie/ Gardeazabal 2003	Basque Country	Counterfactual Analysis (creation of a synthetic case); event study	growth in comparison; stock development;
Lopez/ Wodon 2005	Rwanda	Counterfactual Analysis (statistical outlier correction on time series)	GDP, school enrolment, child mortality
Bilmes and Stiglitz 2006	Iraq	different (incl. a CGE-model)	MILEX; injured soldiers; overall economy of the USA

2.4 Selected Cross-Country Studies in Detail

In what follows, the cross-country studies with the most important contributions are described in detail. Then other studies are summarized briefly.

2.4.1 Collier (1999): First comprehensive study of civil war

Collier motivates his paper by a simple toy model of the steady state capital stock under different conditions compared to a peace-time capital stock. He argues that because of higher transaction costs, total factor productivity falls during a civil war. Given fixed opportunity costs for capital, e.g. because of given interest rates on the world market, agents want to adjust their capital stock downward in the long run under a civil war. After war, total factor productivity jump up again, but remains lower than during peace time. So does the new long-run capital stock, which lies in between the civil war and peace-time capital stock. When a civil war lasted long enough for the capital stock to be adjusted to its war-time equilibrium level, growth will actually be accelerated during the post-war period.

The underlying data comes from the PWT including data from 1960 to 1989, data on civil wars from the Correlates of War project. In total the combined data covers 92 countries with 19 civil wars. The dependent variable is defined as average GDP growth per capita during a decade, giving at most four data points per country.

Technical issues apart, Collier's work is interesting since he controls for characteristics of civil wars. Specifically, he includes months of civil war (Warmonths), and the number of potential recovery months in the first five years after the civil war during the decade (Postwar). Motivated by his argument that after a long civil war the postwar steady state might actually lie above the actual civil war steady state, he includes an interaction term between the two, called Legacy. He controls for ethnic fractionalization, landlocked countries, initial income, and schooling.

Collier employs three different estimators. He uses pooled OLS with continent and time fixed effects, a within-group (fixed effects) estimator, and a Generalized Least Squares (random effects) estimator. His main finding is that when during the whole decade there is civil war (i.e. 120 months of war) the growth effect is -2.2 percentage points p.a. The negative effect of the postwar-period on growth diminishes with the length of the civil war and becomes zero after 55 months of war. After one year of civil war and assuming that in each month in the period was a post-war month gives a negative impact of -2.1 percentage points p.a. Additionally, he actually finds an automatic "peace dividend" through convergence when initial income falls.

Methodologically, his paper is weak. Remarkable is the differentiation for civil war characteristics, but the specification seems arbitrary and does not fully incorporate dynamic

responses to war.[6] However, the econometric specification is problematic. As criticized by Imai and Weinstein (2000), Collier reports estimates for coefficients time-invariant variables using a fixed-effects estimator, despite the fact that these cannot be consistently estimated with four time-periods only. Ignoring this deficiency, he does a Hausman test to confirm that the hypothesis of consistency of pooled OLS and Generalized Least Squares (GLS) can be maintained, i.e. that there is no problem of unobserved heterogeneity. With respect to inference, he does not take possible autocorrelation of standard errors into account. His results might be inconsistent due to omitted variable bias because he fails to include investment, which is not only determined by civil wars and usually considered a major growth determinant.

2.4.2 Gupta et al. (2004): Identifying direct and indirect effects of conflict

Gupta et al. conjecture that because of the likely erosion of the tax base during war, negative growth effects of military expenditure, and positive income effects on revenue, there is a need to estimate jointly the effects of conflict on growth with government revenues and military expenditure.

In contrast to most of the existing literature, they use two different definitions of conflicts. Apart from the standard UCDP/PRIO definition of major conflicts (1000+ cumulated battle deaths) they also consider an indicator provided by the International Country Risk Guide, which is a service for investors and includes the threat of terrorism. They focus their analysis on 66 low and middle-income countries, despite the fact that both conflict indicators are available for a much broader set of countries. They use non-overlapping 5-year averages for the time from 1980 to 1999. They find that the proportion of years spent in major conflict according to the UCDP/PRIO indicator lowers growth by 2.17 percentage points and has no further indirect effects. For the ICRG indicator, they find the opposite: this indicator has only significant indirect growth effects. A related point of interest is that military expenditure of neighboring countries also drives up military expenditure at home, suggesting the existence of international spill-overs.

[6] Why should the postwar-effect be over after five years? Perhaps the economy adjusts to war over time and the war-time effect is not linear in warmonths and before-the-decade war months should also be included (which is feasible using Correlates of War data). Also one might argue, that the impact effect of a civil war is stronger than the continuation effect.

The main innovation of their paper is their explicit modeling of the channel through which conflicts affect growth. Collier (1999) simply omits investment in physical capital to model the growth effects via the adjustment of the capital stock. Therefore, they estimate a partly simultaneous system of three equations using a Generalized Methods of Moments (GMM) estimator.[7] They include regional and time dummies into their regression and instrument investment but treat conflicts as exogenous because of an alleged lack of suitable instruments. This might be problematic. Additionally, no dynamic adjustment effects are allowed for and it is questionable why the counterfactuals are restricted to low and middle-income countries only.

2.4.3 Hess (2003): Welfare analysis of economic costs of conflict

Hess adopts Lucas (1987) framework of risk-averse, infinitely lived dynasties of representative consumers to compute a lower bound of the welfare costs of conflict. In this framework, conflicts affect welfare by making consumption growth for a given trend more volatile and by lowering the trend growth. To convert his empirical estimates of trend growth and volatility effects of conflicts into welfare, he has to make assumptions about the curvature of the utility function, i.e. the degree of risk-aversion, as well as about the discount factor with which future utility is discounted.

The consumption growth data used by Hess (2003) is the yearly data from the Penn World Tables for 1960 to 1992. Data on different types of conflicts comes from the State Failure Data Set for internal conflicts and from the International Crisis Behavior data set for external conflicts. When external are mentioned in the Correlates of War dataset, they are considered large.

His estimation of the growth effects is related to his theoretical model. He assumes that future consumption growth is unrelated to fundamentals such as current income. This assumption is justified when consumers optimize lifetime consumption and certain additional assumptions, e.g. that agents are not credit-constrained and the interest rate just compensates consumers for their impatience. Then the consumers would incorporate all news about the future and change consumption tomorrow only due to information not known today. He then implicitly assumes that conflicts represent unforeseeable information. He only controls for country and time-

[7] While the GMM estimator allows for heteroskedastic and autocorrelated disturbances, they report only heteroskedasticity-consistent standard errors.

fixed effects. Given that he uses more than 40 time periods and many countries, both effects can in principle be consistently estimated. Since time effects are common to all countries they capture world-wide effects of conflict. By estimating the growth equation again without including conflicts, of how time-fixed effects differ when they have to capture the global effects of conflicts.

In his model of the effect of conflicts, he allows via three different dummies for each type of conflict, for different effects of the onset of conflict, the continuation of conflict and the end of conflict. He also allows for different effects of up to eight different types of conflict in both the growth and the volatility equation. The volatility equation is based on the volatility of the predicted consumption during peace.

On basis of his estimates he uses a certain specification of life-time utility to compute that consumers in conflict-affected countries would be willing to give up 9% of their current consumption level permanently in order to avoid wars. In countries affected by wars only indirectly, consumers would still give up about 1% of consumption.

The main merit of this paper is that of computing actual welfare costs of conflict instead of output losses. In line with the theoretical framework, he also takes welfare effects of increased volatility into account. Additionally he makes some attempt to account for dynamic effects. There is, nevertheless, room for criticism based on the econometric estimates alone. The dynamic effects are discrete changes, i.e. there is no smooth adjustment to the onset of a war. Postwar-effects are allowed in one period only. Additionally, the omission of any regressors but conflict-dummies and time and country-dummies can cause omitted variables bias when the permanent income hypothesis in its pure form fails – which is likely in light of the literature. One way to frame this criticism is to say that Hess assumes that consumption growth across countries differs systematically only due to time-invariant effects and conflicts, which seems unlikely. Again, endogeneity is not considered in the estimation but just in the calibration exercise.

2.4.4 Soares (2006): A monetary metric for loss of human life

Soares' work is not directly related to the costs of conflict but is relevant because it shows how a different methodology allows express costs because of the loss of lives in monetary terms. Soares computes the marginal willingness to pay (MWP) for a complete abolition of homicides across a sample of 72 countries. He assumes that agents optimize their lifetime

consumption taking future income and the probability of survival as exogenously given. Given the value function of lifetime utility, he then equates the MWP to the marginal increase in the optimal lifetime utility when violence decreases by a marginal amount. This gives an individual's MWP. He computes the social MWP by applying weights of the population today and in the future (by extrapolating population birth rates) to the individuals' MWP, which is dependent on individual age.

The empirical computation is done using the discrete difference of actual survival probabilities for different age groups and counterfactual probabilities which exclude violent deaths instead of the marginal change. Terms of trade adjusted real GDP per capita is used as income; all data is based on averages from 1990-99. The instantaneous utility function is the same as that used by Hess plus a constant and is calibrated using parameters taken from the literature. The discount factor is assumed to equal the inverse of the interest rate. Since it is additionally assumed that income is constant and initial wealth zero, consumption equals income in each period.

For the purpose of estimating the costs of conflict, the paper is interesting insofar as it allows expressing costs of life in a monetary scale. This comes at the cost of assumptions about functional forms and unrealistic assumptions, which might matter more for conflicts than for homicides. Violence may not only alter consumption decisions over time but also affect income via the type of investments undertaken and the technologies adopted. Soares also shows that income inequality changes his results and one might, more generally, question whether absence of violence is a luxury good or not. Additionally, the computation of survival probabilities could be improved (cohort effects; counterfactual not only for death flow but also for population stocks).

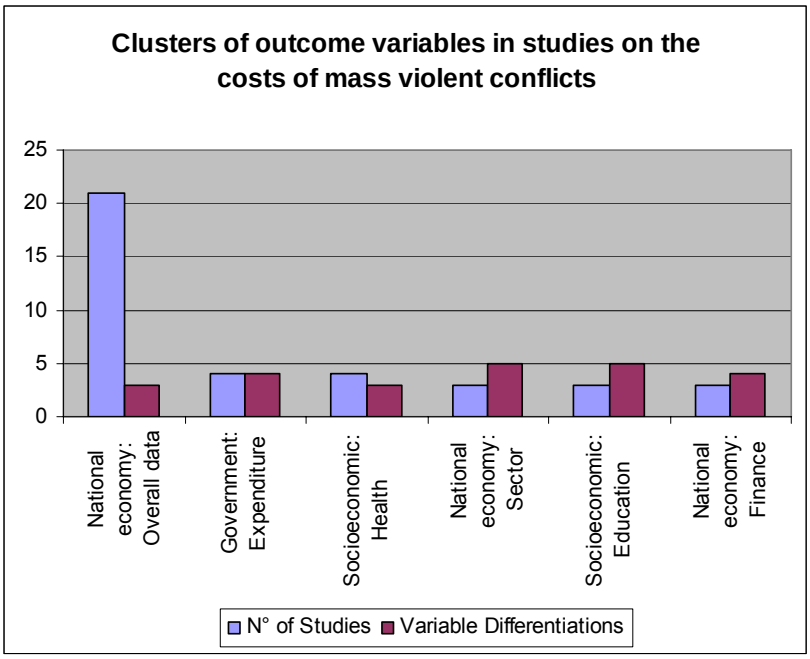
3 Evaluation I: Content

Based on the literature surveyed in the preceding chapter, this chapter sets out to provide a critical summary of the literature with respect to the content of the studies. In the first subsection, the topics of the existing literature are summarized, while the second subsection provides empirical findings on how conflict affects different countries. Based on this description of the status quo of the research into costs of conflict, the third and last subsection concludes the chapter by highlighting topics which were not or not satisfactorily covered in the literature.

3.1 Considered Topics of the Analysis

What is striking when considering the existing literature is the consideration of very different aspects of economic costs and influences by different studies. This hints at the still quite autistic contributions to the debate. However, regarding the key impacts of civil war (Figure 3–1), we can see – quite unsurprisingly – an overall concentration on macroeconomic data, which includes GDP as well as growth. Just a few studies consider explicitly other aspects like government expenditure, health, and education. The number of different variable specifications shows a higher level of disaggregated data in these fields in comparison to the number of conducted studies.

Figure 3-1
Analyzed Impacts of Mass Violent Conflicts

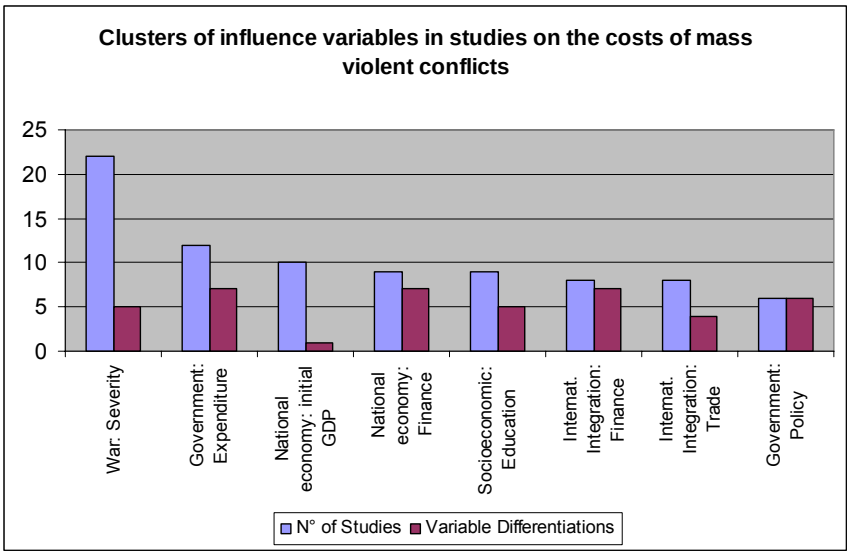


Source: own calculations

A diverse picture is shown in.Figure 3–2, All studies regard war in one or the other way. Its differentiation is along severity, duration, and geographical spread. However, along the control variables, we can note a broad range of considered influences, from government decisions, to initial GDP, to education.

Altogether the studies focus on over 30 different impacts of war and control for more than 80 different indicators of influence.

Figure 3-2
Determinants of Development other than Conflict in the Literature



Source: own calculations

3.2 Empirical Findings

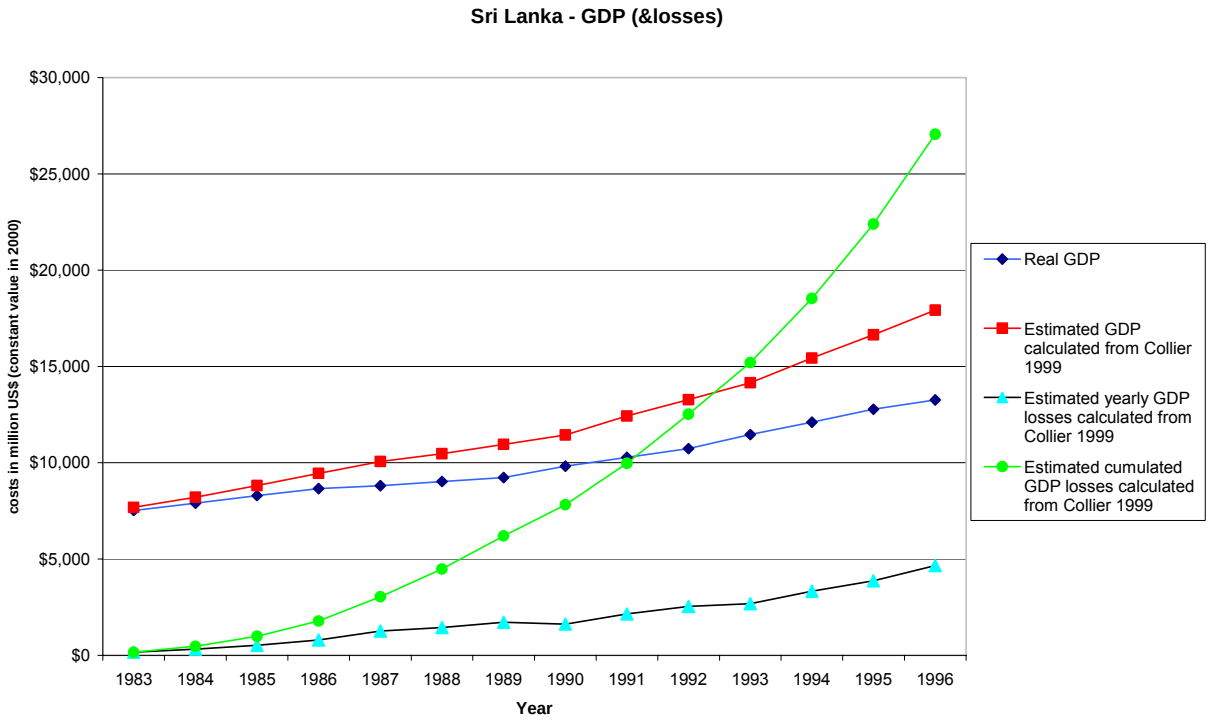
The empirical findings can be separated into general trends and specific findings, analyzed in 3.2.1 and 3.2.2. However, a series of gaps has to be treated in the next part.

3.2.1 General trends

Given the different variable specifications, empirical findings – above all numbers – of existing studies have to be compared carefully. However, we can differentiate certain trends.

GDP and Growth: Contrary to the phoenix-factor debate, there are few signs that war could have a positive effect regarding the overall macro-economic indicators. Although highly different in absolute numbers, all contemporary studies calculate a negative effect of civil wars on the national economy. Growth-related studies show, furthermore, that we do not just have a temporary loss in absolute numbers, but additionally we have a reduction in economic development, which leads to further losses in the consequent years. As Figure 3–3 (calculated from Collier 1999) shows for Sri Lanka, losses in growth lead to an exponential loss of absolute GDP-values, best seen in the cumulated GDP-losses.

Figure 3-3
An Illustration of Dynamics of Costs of Conflict for the Case of Sri Lanka



Source: own calculations from Collier 1999

Investment: Although the channels of costs of conflict are various, most studies regard missing investment as one of the main problems for war-torn economies. On the link between war and missing investment, studies differ in their estimations. A range of studies focuses on a decrease of public investment as military expenditures rise. Transnational developments are another prominent explanation. On the one hand, war leads to losses of value abroad, regarding higher import-duties as well as capital flight. On the other hand, capital inflow is reduced by a decrease of export-revenues and foreign direct investment. Rather sketchily addressed are forms of (reduced) investment in human, social, and institutional capital.

Dynamics of Costs: It is generally recognized that mass violent conflicts have long term effects, which exceed peace agreements and/or ceasefires. These costs are explained on the one hand by the need to reconstruct damaged infrastructure, but on the other hand, by more long-term consequences as well, e.g. capital flight and insecurity (Collier 1999), reduced healthcare (Ghobarah et al. 2003), and missed education (Lai/Thyne 2007).

3.2.2 Specific findings

For an overview of the specific effects of conflict, the findings can be grouped into broad topics.

Fiscal Consequences: Mass violent conflicts have an extraordinary impact on the public budget. On the income side, contemporary mass violent conflicts can lead to a strong decrease in tax revenues, as on the one hand the tax base erodes due to reduced taxable complex economic activity, and on the other hand, the state's capacity to collect taxes diminishes. This is quite the opposite of the results of the traditional interstate war debate, which highlights a correlation of war and the state's control of the economy. On the allocation side, the share of military expenditure increases (Grobar/Gnanaselvam 1993; Harris 1997; Gupta et al. 2004). Against the truism that a diverted fiscal budget leads to a breakdown of social services, no shift of assets from schooling and health care to military expenditure can be proven (Gupta et al. 2004; Lai/Thyne 2007). Empirically, it seems that the burden is carried by (reduced) public investments (FitzGerald 1987; Grobar/Gnanaselvam 1993; Gupta et al. 2004). This analysis regards the share of the different items in the public budget. As we observe a general decline of the size of the budget, so too are there losses in absolute numbers for public services like schooling and health care (Ghobarah et al. 2003; Lai/Thyne 2007).

Productive Capital: Mass violent conflicts lead to the destruction of productive capital. Next to houses and machinery, this includes infrastructure as well as land. (Richardson/Samarasinghe 1991; Kelegama 1999) Land mines have an especially long-lasting impact on the economic base of a country (Hoeffler/Reynal-Querol 2003). The kind of economy and the type of conflict have a key impact on the severity of destruction and the possibility to prevent it (Collier 1999; Imai/Weinstein 2000). As obvious as these statements are for a general account of costs of conflict, empirical studies face a severe problem of double counting, when cumulating the production costs of productive capital and the lost output. The lost output already encompasses the investment costs into productive capital (Arunatilake et al. 2001).

Financial Capital is another severe problem for conflict-torn economies. This does not just concern the flight of capital and missing foreign direct investments, but the local financial infrastructure, as the sector of financial services is highly vulnerable to conflict-related attacks (Collier 1999). Additionally, conflict-torn economies face the problem of high inflation rates

(Harris 1997), which can further destabilize the financial sector. In consequence, financial markets are severely damaged.

Human Capital: The analyzed studies regard above all two dimensions of human security: health and education. Regarding health studies show an increase in mortality rates. Non-combatants are severely affected, as war is responsible for the destruction of health infrastructure and is strongly correlated to the spread of diseases like malaria and tuberculosis (Stewart/Humphrey 1997; Hoeffler & Reynal-Querol 2003; Ghobarah et al. 2003). Concerning education, it is generally acknowledged that war has a negative effect on schooling. However, there is no consensus about disaggregate data. While Lai and Thyne (2007) do see males in secondary schools as the primary victim of war regarding schooling, micro-economic studies like Justino (2006) and Shemyakina (2006) find girls to be the most vulnerable victims in this area. This puzzle has to be solved in further research.

Transaction Costs: In his seminal paper, Collier (1999) argues that the Total Factor Productivity in a country experiencing a civil war will decrease due to disruption effects. In a sector analysis, he shows that transaction-intensive industries suffer most from a civil war. Related to this are declining consumer and investor confidence as described by Nordhaus (2002) for the first Persian Gulf War. Sheppard (2005) summarizes literature on spatial economics and verifies central claims using city-level data that on-going terrorist threats will lower the long-run extent of urban areas. In contrast, one-time external war shocks might have only temporary effects. Insofar as urban areas and cities evolved to minimize transport and other transaction costs, this literature makes a further case for considering transaction costs.

Institutions and Policy: As argued by Collier and Hoeffler (2004), institutions and policies are especially important in post-conflict situations as they determine how effective development aid is. Thus, they represent an important channel for assessing the costs of conflict. Collier and Hoeffler suggest that social policies are especially important after the onset of peace. Also Easterly et al. (1993) argue that (external) war has an important indirect growth effect via its impact on the black-market premium, which they consider as a policy variable.

Aid: The links between aid and development, as well as between aid and conflict, are highly disputed on the political agenda. In the debate on the economic consequences of mass violent conflict, aid is generally tested as a control variable. Furthermore it is related to the field of foreign debt (Alvarez-Plata/Brück 2006). Another question relates to the global (re-)allocation

of aid as a consequence of high-publicity events like mass violent conflicts (prominently labeled CNN-effect). However, in light of our research task, we can not trace this whole debate (cp. Collier/Hoeffler 2004; Suhrke et al. 2005).

3.3 Research Gaps

If we consider the findings in the previous part, we can see two kinds of content-related research gaps. Insufficiently analyzed or missing topics are one gap, disputed topics the other one. In the remainder of this chapter, we first highlight topical issues which deserve further attention in macroeconomic studies. We proceed by discussing how these future macroeconomic studies should be compared with studies using micro-level data. Additionally, we argue that a differentiated understanding of costs, which exceeds GDP and growth, should be attempted (Hess 2003; Suhrke et al. 2005) and point out possible dimensions. Finally, a conclusion on the current state of the research is offered.

3.3.1 Analyzing different forms of mass violent conflicts

A general comparison of single-case studies does support the hypothesis that the form of mass violent conflicts, as well as the form of the linked war economy, has a significant impact on their economic costs (cp. Jean/Ruffin 1996). In the debate on these costs, except from a differentiation on the duration of war, only a few attempts have been made to disaggregate forms of mass violent conflicts other than the interstate war/internal war-categorization, for example by including a coefficient on the spread of violence (Imai/Weinstein 2000). Here, further research has to be done, for example by including findings of the war-economy debate (Jean/Ruffin 1996; Ross 2004).

Internationalized conflicts: A cross-theme between types of war and transnational dimension are ‘internationalized armed conflicts’ – as labeled and coded by the UCDP/PRIO dataset. Until now, not any cross-country study differentiated external intervention – neither theoretical nor empirical. This is astonishing, since for example during the period 2000-2006, 9 out of 39 war-years (or 5 out of 17 conflicts) on the highest intensity level have been considered as ‘internationalized’ according to the UCDP/PRIO dataset. These interventions are normally framed by a whole range of actions, from military support to resource export to pressure on policy reforms and aid inflows. Therefore, economic consequences should be expected and analyzed regarding the costs of conflict (cp. Bilmes/Stiglitz 2006)

3.3.2 Including channels of indirect effects

Most regression analyses control for several factors to differentiate between war and non-war-related components of economic development. However, as disaggregate data on schooling, health etc. (Brück 1997; Stewart/FitzGerald 2001; Ghobarah et al. 2003; Lai/Thyne 2007) shows, most of these factors are highly affected by war. This is of course a central methodological problem (cp. chapter 4). But next to it, it has also a content-related dimension. Only if we understand the spillovers of specific effects, can we discuss policies to reduce the costs of mass violent conflicts. Therefore, more effort has to be invested into the understanding of channels of costs of conflicts and its cross linkages.

International spillovers: This channel has to be analyzed in a bidirectional way. The range of external influences spans from external military and political intervention to direct investments and capital lending. On the other hand, mass violent conflicts in one area lead to a variety of externalities. Direct effects are refugees, insecure boarder lands due to areas of retreat, to an extension of direct military struggles onto foreign territory. Indirect effects are diverted trade routes, higher public expenditures in foreign countries for security and emergency services, and a regional and global re-allocation of aid. All these components are influenced by war and represent conflict-related costs and benefits. Previous studies did consider global or regional dimensions in one or the other way. However, as focused on single cases (even if combined in a cross-country regression analysis) these topics were addressed only in a few studies. Murdoch and Sandler (2004) consider growth effects of conflicts in neighboring countries. Other externalities, and the channels through which they manifest themselves, have however not yet been analyzed. Regarding a regional or global calculation of costs of mass violent conflicts, these externalities have to be differentiated and included in a comprehensive calculation.

Dynamics of costs: This topic has already been noted in the general findings. However, further research has to be done to account for costs developments during conflicts and above all after conflicts. On the dynamics of macro-economic data, it is possible to improve existing findings on post-conflict effects on development (cp. Brück 1997; Collier 1999; Hess 2003; Collier/Hoeffler 2004; Suhrke et al. 2005) and influences like aid, policies, UN-peacekeeping forces (cp. Kang/Meernik 2005) etc., which are supposed to have an influence on post-conflict economic development and therefore on the costs of mass violent conflicts. The variety of existing contributions suggests that this topic should be included in all research

concerning the costs of conflict. The existing literature could, however, be improved by relying less on a priori specified forms of the effect and by combining the methodology applied by different researchers. The related methodological issues are discussed in section 4.

Positive spill-over of military expenditure: While most of the traditional debate focuses on a positive spill-over of military expenditure (van Raemdonck/Diehl 1989), the contemporary debate tread military expenditure as pure sunk costs (Harris 1997). This could be hypothesized as the theoretical consequence of the characteristics of the dominant types of mass violent conflicts, as for example low-level weapon-technology-usage in civil wars in comparison to interstate wars. However, only Gupta et al. (2004) analyze this channel in a cross-country context.

Human Capital: Education is generally understood as strongly interrelated with conflict (Lai/Thyne 2007). However, the indirect effects of conflict on overall development such as GDP growth via its negative on education have not yet been analyzed. Similarly, **physical capital** losses and negative effects on investment have not been analyzed simultaneously with growth effects. Imai and Weinstein (2000) analyze the effect of conflicts on investment but do not model explicitly the connection between conflicts, investment, and growth.

Sector Analysis: Another approach is sketched in the second part of Collier's 1999 paper. He analyses microeconomic hypotheses (cp. Brück 1997): mass violent conflicts do affect economic sectors differently. For example highly transaction intensive sectors like the transport-sector are more vulnerable than subsistence economies. His first attempt does show conclusive trends, no further analysis has been done since, although different sectoral compositions can have potentially important impacts on future development via technological progress.

Concerning **transaction costs** and **institutions and policy** there is evidence from different studies, as outlined above, that these also are important in the transmission of the effects of civil war on development. However, so far no study has set out to model this in a macroeconomic context. Furthermore, existing studies, such as Easterly et al. (1993) and Sheppard (2005), do not quantify the precise effects on overall development.[8]

[8] Notice, however, that doing so was also not intended by the authors. They rather touch upon the issues analyzed here while analyzing different topics.

3.3.3 Cross-checking macroeconomic studies with micro data

This leads us directly to the chances of stronger macro-micro cooperation, as called for by Justino (2006). From sector analysis to social capital, refugees, and gender, micro-economic studies offer a broad range of hypothesis on the consequences of mass violent conflicts. This reservoir of knowledge has been more or less neglected by the current debate on the costs of conflict. The substantial difference on methodology and data between these two disciplines cannot be brushed aside. But it seems that micro-level studies could help macro-economic studies to understand channels more precisely and above all to construct a consistent theory of costs of conflicts. As macro-findings might be a pure statistical artifact due to aggregation problems, verification of their predictions is important and is one of the most important gaps in the analyzed studies. Some concrete starting points can be mentioned.

One aspect regards **transaction costs**. These costs include costs on the mentioned reduction of financial services, as well as transport costs and costs of higher security measures on markets. Here empirical studies of economic geography models (e.g. Sheppard 2005) or micro-level studies on migration or financial development might provide further insights. Next to widely considered human capital, **social capital** has to be considered. As mentioned by Justino (2006), the displacement of people leads to an alteration of social networks. This has consequences for coping strategies and consequently for economic development. Given the importance of social networks for technology adoption, these effects can have potentially important consequences (Bandiera and Rasul 2006). **Coping strategies** are furthermore influenced by other factors, like the labor market, skills, policy reforms, etc. (Brück 1997, Justino 2006). These have an effect on economic development and, therefore, on the calculation of economic costs of mass violent conflicts because of changing behavior. The success of coping strategies might depend on the institutional environment: Most studies mention a change in the **institutional capital** of a society, from the state of law, to democratic accountability, to non-governmental institutions as modes of stabilization and a reduction of insecurity. Its consequences for the economic development and therefore on the reduction of costs of conflicts are a common place.

Collier and Hoeffler (2004) use the World Bank CPIA rating. They suggest that especially social policies, and less so structural policies, are important relative to macroeconomic policies after a civil war. As social policies and structural affect, respectively, citizens and

firms directly, this suggests investigating how these policies work exactly as results based on ratings usually do not lend themselves easily for policy advice.[9]

3.3.4 Indicators of Development and Welfare: GDP and beyond

The focus on GDP per capita and GDP per capita growth is a standard procedure in economic analysis, and it facilitates the calculation of the overall economic development of a country. GDP measures the value added generated through in market activities. Its merit is that it is measured frequently in most countries of the world. It is also a good approximation for national income[10] and should, over longer horizons, be closely related to consumption. When national income or consumption determines welfare, GDP can be regarded as a good proxy, that encompasses the entire economy. This is the rationale underlying the widespread use of GDP.

Even in this respect, GDP has its shortcomings. It counts all value added generated in market activities. These may include activities which generate a net loss: GDP includes value added generated in environmental protection or repair of traffic accidents but does not include the losses through pollution or accidents. Unpaid work in households or voluntary activity is also excluded. Additionally, GDP per capita does not provide information on the distribution of income or consumption, even if it proxies for those at an aggregate level. While GDP provides a rough and widely-used indicator of development, other measures of welfare and inequality can provide valuable additional insights.

Welfare: One possibility to further insights into economic costs and benefits of mass violent conflicts is a differentiated analysis on welfare. This could be based on consumption rather than GDP. Possible ways to implement such an analysis are discussed in section 4.2.

Inequality and Gender: A lot of single-case studies show the relevance of inequality of different groups in conflict-torn societies. The Gini-Coefficient is a commonly used indicator for income inequality. However, no attempt has yet been done to gather more generalized insights into the link between mass violent conflicts and inequality. A project at the German Institute for Economic Research tries to fill this gap. Concerning gender, it is generally recognized that mass violent conflicts do affect gender questions in several ways, from

[9] Cp. Carothers (2003) who pointed out such a problem for the literature on the Rule of Law and triggered subsequently more applied research.

[10] The Gross National Product includes net factor payments with the rest of the world and therefore gives national income.

gender-related warfare to new forms of gender-relations because of new household production structures (Justino 2006). But the consequences for conflict and post-conflict societies and economies are still underrepresented in the analysis of the economic costs of conflicts (Brück/Vothknecht 2007).

3.3.5 Conclusion on theoretical and operational quality

Differentiating the mentioned analyzed components, we can see a Babylonian muddle of variables. This shows that a more organic analysis of the costs of conflict is missing. What is needed is a more theoretical underpinning of the costs of conflict, which goes beyond a mere eclectic accumulation of different items of costs. Furthermore, these theoretical considerations have to be operationalized to close the gap between mere philosophical considerations of costs of mass violent conflicts and empirical calculations.

The state of the art leads to several problems:

a) the comparison of different studies is nearly impossible – as shown in the single-country studies – since the definitions of the various items of costs are countless;
b) the detection of double counting for the authors as well as for critics is nearly impossible, if no transparent analysis of the links between the different items of costs of conflict can be traced;
c) this hinders consequently the differentiated understanding of the broad origin and concrete realization of costs of conflict;
d) which finally leads to vague policy advice that is not linked to the previous analyses (cp. Suhrke et al. 2005).

4 Evaluation II: Methodology

Modeling the impact of conflict on human development and aggregating it into the costs of conflict poses several difficulties. First, it is difficult to identify causal relationships between conflict and development. Other factors apart from conflict might have changed and unobserved factors, that cause low development may at the same time raise the probability of conflict. This is usually done using standard regression analysis and is considered in the first section of this chapter. Second, even when a causal effect is identified, it is unclear how to aggregate lost human lives and lost economic opportunities into a single number. This can be based on regression analysis and is discussed in the second section. In the entire chapter, the

main focus in on cross-country studies. This is because computations of global costs of conflict should ideally be based on estimates of a broad sample of countries.

4.1 Regression Analysis: Identifying causal effects of conflict

With respect to the first difficulty, a different way to phrase it is to ask: What would have happened in the absence of conflict? Clearly, determinants of development other than conflict hardly remain unchanged. The world environment and the domestic economy change on several dimensions at the same time. Therefore, it is important to build a counterfactual that models how we would expect an otherwise identical country to develop in the absence of war. Technically, we want to compute the expectation of a set of indicators of development, say $\mathbf{y}$, given a set of characteristics of the country and the world $\mathbf{x}$ with and without war. If w is an indicator that equals unity if the country had a war and is otherwise zero, we want to compare:

$E(\mathbf{y} \mid \mathbf{x}, w=0)$ and $E(\mathbf{y} \mid \mathbf{x}, w=1)$.

The most common framework for this computation is to assume that the relationship between development and its determinants is linear. This yields the following population relationship:

$$E(\mathbf{y} \mid \mathbf{x}, w) = \mathbf{x}'\beta_x + w\,\beta_w \equiv \mathbf{z}'\beta_z. \quad (1)$$

Since this relationship holds for all vectors of random variables $\mathbf{z}=(\mathbf{x}, w)$, it also holds for country i at time t:

$$E(\mathbf{y}_{it} \mid \mathbf{x}_{it}, w_{it}) = \mathbf{x}_{it}'\beta_x + w_{it}\,\beta_w \equiv \mathbf{z}_{it}'\beta_z. \quad (1')$$

Here β_W denotes the expected change in the development indicators due to a war. However, we cannot observe the expected values and must rely on the observed valued of $\mathbf{y}_{it}$ to identify β_W and the other parameters of the expectation. Observed values include, however, an unexplained component – an error term or a "shock":

$$\mathbf{y}_{it} = E(\mathbf{y}_{it} \mid \mathbf{x}_{it}, w_{it}) + \varepsilon_{it} = \mathbf{x}_{it}'\beta_x + w_{it}\,\beta_w + \varepsilon_{it} \quad (2)$$

The most common estimator, the OLS estimator, chooses the parameters so as to minimize the squared sum of the unexplained component. Put differently, this estimator chooses the parameters so that the characteristics $\mathbf{z}_{it}$ are uncorrelated with the unexplained component, i.e.

$$E(\mathbf{x}_{it}\varepsilon_{it}) = \mathbf{0} \text{ and } E(w_{it}\varepsilon_{it}) = \mathbf{0} \Rightarrow \quad E(\mathbf{z}_{it}\varepsilon_{it}) = \mathbf{0} \quad (3)$$

Re-writing equation (3) yields $E(\mathbf{z}_{it}\varepsilon_{it}) = E[\mathbf{z}_{it}(\mathbf{y}_{it} - E(\mathbf{y}_{it} \mid \mathbf{z}_{it}))] = E[\mathbf{z}_{it}\mathbf{y}_{it}] - E[\mathbf{z}_{it}\,\mathbf{z}_{it}']\,\beta_z = \mathbf{0}$. This allows solving for the parameter vector β_z as:

$$\boldsymbol{\beta}_z = E(\mathbf{z}_{it}\mathbf{z}_{it}')^{-1} E(\mathbf{z}_{it}\, \mathbf{y}_{it}) \quad (4)$$

The estimator **b** replaces the expectation with the analogue observed in the sample:

$$\mathbf{b}_z = [\Sigma_i\Sigma_t(\mathbf{z}_{it}\mathbf{z}_{it}')]^{-1} [\Sigma_i\Sigma_t(\mathbf{z}_{it}\mathbf{y}_{it})] \quad \text{where } i = 1, \ldots, N \text{ and } t = 1, \ldots, T. \quad (5)$$

Here N and T denote the number of countries and the number of time periods observed for each country.[11] This estimator is called the pooled OLS estimator since it effectively treats the variation within countries over time and across countries at each point in time in the same way. Under the assumptions made above, it is consistent, i.e. $\mathbf{b}_z$ converges in probability to the true parameters $\boldsymbol{\beta}_z$. This treatment may, as discussed below, be inefficient and may – under more general assumptions – even lead to inconsistent parameter estimates.

The simplistic model introduced above serves to illustrate the potential problems in identifying causal relationships between conflict and development.[12] One issue with the simple model outlined above is that past conflicts do not affect development. Thus, equation (1) must be modified to allow characteristics of past conflicts to affect development in a dynamic way. When, in contrary to the assumption in equation (3), the error term might be related to the country characteristics or the probability of conflict, two additional problems may arise. In either of the two cases, the estimator in (5) is no longer a consistent estimator of the 'true' parameters in the population relationship (1). This problem is one of unobserved heterogeneity across countries or simultaneous causation of conflicts and development. Another difficulty is posed by the fact that our ability to observe the indicators of development might be systematically related to country or conflict characteristics. In this case, a non-ignorable sample selection problem is possible.

In addition to these issues, which are discussed in the context of the regression framework, we also discuss additional techniques in the least subsection.

4.1.1 Modeling Dynamic Effects

To simplify the discussion,[13] assume that the development measure **y** consists of a single variable. Then a straightforward way to introduce dynamics into the model is to augment the

[11] It is straightforward but demanding in terms of notation to allow for a different number of observed time periods for each country. For the sake of simplicity in the exposition, it is assumed that all countries are observed during all periods.

[12] This treatment and subsequent extensions are based on standard results presented in Wooldridge (2002).

[13] Otherwise we would have the case of a panel-VAR, whose exposition would exceed the space available in this chapter.

model by past conflict characteristics or one or more lags of the endogenous variable. That is, re-write the model in equation (2) as:

$$y_{it} = \Sigma_s y_{it-s}\beta_{y,s} + \mathbf{x}_{it}'\boldsymbol{\beta}_x + \Sigma_u \mathbf{w}_{it-u}'\boldsymbol{\beta}_{w,u} + \boldsymbol{\varepsilon}_{it}, \qquad s = 1, ..., p; \quad u = 0, \ldots, q. \qquad (2')$$

To make sense of this definition, notice first that introducing lags of the development measure y_{it}. When the k'th components of $\mathbf{x}_{it,}$ $x_{it}^{(k)}$, changes in period t by one unit to a permanently higher level, the immediate effect on y is given by $\beta_x^{(k)}$. In the next period, there will be an additional increase in y_{it+1} because of the increase in y_{it} – this increase is given by $\beta_{y,1} \times \beta_x^{(k)}$, yielding a total change of $(1+\beta_{y,1}) \times \beta_x^{(k)}$. When the coefficients on the lags of the dependent variable satisfy certain conditions,[14] the long-run effect is given by $1/[1-\Sigma_s \beta_{y,s}] \times \beta_x^{(k)}$. During the adjustment process to the new long-run equilibrium, the initial change in the explanatory variable $x_{it}^{(k)}$ produces a dynamic effect that will eventually die out. This may also potentially be a relevant way to allow for dynamic adjustment of a development measure to conflicts. However, this forces the dynamic effect to be the same in response to conflict than to an increase in educational attainment.

More promising is therefore to focus on the vector of conflict characteristics itself, $\mathbf{w}_{it}$. This may include several dummy-variables characterizing whether the country experiences an ongoing conflict at present, whether the conflict just began, or whether the conflict is over. Without including lagged values of these dummy variables, this corresponds to the model used by Hess (2003). Introducing lags of the variables allows in addition to model conflict-specific dynamic effects. Consider the case when a conflict ends in period t in country i. Assume this is the k'th component of $\mathbf{w}_{it}$, $w_{it}^{(k)}$. This will have an impact effect which is given by $\beta_{w,0}^{(k)}$. In the following period, the effect will be $\beta_{w,1}^{(k)}$, which is potentially different. This specification encompasses different model specifications. In the context of Collier (1999), $\beta_{w,u}^{(k)}$ would depend via u on the time which has elapsed since the end of war.[15] In the case of Lai and Thyne (2007), $\beta_{w,u}^{(k)} = u^{-3} \times \beta_{w,1}^{(k)}$. In general, one would proceed by estimating (2') with a sufficient number q of lags in $\mathbf{w}_{it}$ to model dynamics and then analyze the estimated coefficients. If they fail to be significant from some $\bar{q}$ onwards, one would conclude that after $\bar{q}$ periods, the legacy of conflict is over. By analyzing the behavior of $\beta_{w,u}^{(k)}$, one could

[14] That is, if the roots of the characteristic polynomial $\theta(L) = (1 - \beta_{y,1} L - \ldots - \beta_{y,p} L^p)$ lie outside the unit circle.

[15] Collier's "legacy" effect could be similarly introduced through a separate variable in the vector $\mathbf{w}_{it}$.

deduce functional forms for the dynamic effect instead of imposing them arbitrarily from the beginning.[16]

The above methods of modeling dynamics are in general viable. In many cases, estimation of the modified model (2') is, nevertheless, not possible by using a simple pooled OLS estimator or standard panel estimators for static models. One such case is when the true model includes the lagged dependent variable and, at the same time, unobserved heterogeneity is present. In this case, dynamic panel data methods have to be used such as those summarized in the simple introduction by Bond (2002). This becomes necessary when some unobserved country characteristics included in the error term are correlated with the explanatory variables. As becomes clear by the discussion in the next section, this is a relevant, albeit neglected case in the conflict literature. Generally, indicators of development show a high level of persistence as well as important unobserved and country-specific determinants.

In what follows, the standard estimator for coping with a dynamic model with unobserved heterogeneity is briefly discussed. The standard solution is the application of the Arellano-Bond estimator. This estimator transforms the model in (2') into first differences, hence the common denomination of the estimator as "difference estimator". While this introduces correlation between some regressors, the lagged differences of the endogenous variables, and the error term in first differences, the transformation provides also instruments from within the model to identify the influence of the lagged regressors. Specifically, the moment condition used in the introduction to identify the coefficients of the regressors, $E(\mathbf{z}_{it}\boldsymbol{\varepsilon}_{it}) = E[\mathbf{z}_{it}\mathbf{y}_{it}] - E[\mathbf{z}_{it}\,\mathbf{z}_{it}'] \boldsymbol{\beta}_z = \mathbf{0}$, can be replaced by the following conditions: $E(y_{it-s}\Delta\varepsilon_{it}) = 0$ for all $s \geq 2$ and $E(\mathbf{z}_{it}'\Delta\varepsilon_{it})=\mathbf{0}$. This holds under the assumption that there is no simultaneous causation, and the error terms are serially uncorrelated, and that we consider just one lag of *y* as a regressor. Even when these assumptions fail to hold, the moment conditions for identification can simply be adjusted correspondingly. Under additional assumptions, the efficiency of the estimator can be increased by using moment conditions in levels, e.g. $E(\Delta y_{it-1}\varepsilon_{it}) = 0$ for all $t \geq 3$. This estimator is known as the "system estimator".

The problem with estimators such as the Arellano-Bond estimator is that their properties in large samples are superior to those of the traditional panel estimators for static models described in the following sections when there is autocorrelation in the dependent variable.

[16] When these functional forms as in Lay and Thyne (2007) are a good approximation, estimating (2') with the restriction of the functional form is more efficient than estimating it without the restriction.

While a finite sample correction for small samples has been proposed in the literature (Windmeijer 2005), it is recommendable to test for robustness of the results using the inconsistent Fixed Effects panel estimator because of its possibly superior finite sample properties.

4.1.2 Unobserved heterogeneity

Consider the case in which the unexplained component in the regression model (2) is informative about conflict occurrence or other determinants of development. Assume that we cannot observe or measure the overall culture in a country but that cultural characteristics exert a positive influence on development through work ethics. Assume this increases income through higher productivity. At the same time, culture influences the degree to which violence is an accepted form to settle conflicts. Problems as these are commonly referred to as unobserved heterogeneity.

Formally, the problem of unobserved heterogeneity can be represented as follows. Re-write the error term $\boldsymbol{\varepsilon}_{it}$ as $\mathbf{u}_i + \mathbf{v}_t + \boldsymbol{\mu}_{it}$ so that equation (2) becomes for country *i* at time *t*:

$$\mathbf{y}_{it} = \mathbf{x}_{it}'\boldsymbol{\beta}_x + w_{it}\,\beta_W + \mathbf{u}_i + \mathbf{v}_t + \boldsymbol{\mu}_{it}. \qquad (2')$$

The assumption of unobserved heterogeneity implies then that assumption (3) fails. Let

$$E(\mathbf{x}_{it}\mathbf{u}_i) \neq \mathbf{0} \text{ or } E(w_{it}\mathbf{u}_i) \neq \mathbf{0} \Rightarrow \quad E(\mathbf{z}_{it}\mathbf{u}_i) \neq \mathbf{0}, \qquad (3'a)$$

$$E(\mathbf{x}_{it}\mathbf{v}_t) \neq \mathbf{0} \text{ or } E(w_{it}\mathbf{v}_t) \neq \mathbf{0} \Rightarrow \quad E(\mathbf{z}_{it}\mathbf{v}_t) \neq \mathbf{0}, \qquad (3'b)$$

$$E(\mathbf{x}_{it}\boldsymbol{\mu}_{it}) = \mathbf{0} \text{ and } E(w_{it}\boldsymbol{\mu}_{it}) = \mathbf{0} \Rightarrow \quad E(\mathbf{z}_{it}\boldsymbol{\mu}_{it}) = \mathbf{0}. \qquad (3'c)$$

Assumption (3'a) incorporates the argument made above formally: unobserved or unmeasurable country characteristics are correlated with the prevalence of conflict or other characteristics. (3'b) refers to unobserved heterogeneity over time - $\mathbf{v}_t$ is a vector of unobserved time-effects common to all countries – such as oil-price shocks or the end of the Cold War Era.

When unobserved heterogeneity matters, pooled OLS estimation is inconsistent. This becomes intuitively clear because assumptions (3'a) and (3'b) imply that factors which are unknown drive, for example, growth and conflicts at the same time. When these factors are not controlled for, the estimator interprets this extra correlation induced by unobserved factors mistakenly as a causal effect. When the model remains static, however, controlling for these fixed effects is straightforward. Inclusion of country dummy variables and time dummy

variables allows estimating the effects of the remaining variables, provided they are not time-invariant. Assume for the sake of simplicity that $\mathbf{v}_t = \mathbf{0}$. Inclusion of country dummies amounts to estimating the following model, where $\bar{\mathbf{y}}_i$ denotes the time-average of a variable in country *i*.

$$\mathbf{y}_{it} - \bar{\mathbf{y}}_i = (\mathbf{x}_{it} - \bar{\mathbf{x}}_i)'\boldsymbol{\beta}_x + (w_{it} - \bar{w}_i)\beta_W + (\boldsymbol{\mu}_{it} - \bar{\boldsymbol{\mu}}_i). \qquad (2')$$

This transformed model can be estimated again using pooled OLS. This is known as the Fixed Effects (FE) estimator. However, no effects of time-invariant variables can be consistently identified, although Collier (1999) reports two such coefficients. Additionally, standard inference even with heteroskedasticity-consistent standard errors is not valid and at least standard errors clustered by countries should be employed (Stock and Watson, 2006). Although the case for such standard errors has been made early (Arellano, 1987), apparently only two papers in the conflict literature make such an adjustment (Lai and Thyne, 2007; Gupta et al., 2004).[17]

When only time-effects matter, i.e. (3'a) does not hold, the pooled OLS estimator is consistent, but inefficient. To see this, notice that $\mathbf{z}_{it} \equiv (\mathbf{z}_{it} - \bar{\mathbf{z}}_i) + \bar{\mathbf{z}}_i$, where the first component in brackets denotes the within-country (WC) variation, and the second component varies only between countries (BC). Then, we can re-write the OLS estimator as:

$$\mathbf{b}_z = [\Sigma_i\Sigma_t(\mathbf{z}_{it}\mathbf{z}_{it}')]^{-1}\,[\Sigma_i\Sigma_t(\mathbf{z}_{it}\mathbf{y}_{it})] \equiv [\mathbf{WC}_{\mathbf{zz}} + \mathbf{BC}_{\mathbf{zz}}]^{-1}\,[\mathbf{WC}_{\mathbf{zy}} + \mathbf{BC}_{\mathbf{zy}}].$$

This shows that the within and between country-variation receives equal weights. When the variation in the country-specific error terms $\mathbf{u}_i$ is very high, it is hard to disentangle variation in $\bar{\mathbf{z}}_i$ between countries from the variation of the unobserved factors. It is therefore efficient to weight the two components of variation according to their relative variances. This is commonly known as the Random Effects (RE) estimator. It is given by:

$$\mathbf{b}_z^{RE} = [\mathbf{WC}_{\mathbf{zz}} + \theta\mathbf{BC}_{\mathbf{zz}}]^{-1}\,[\mathbf{WC}_{\mathbf{zy}} + \theta\mathbf{BC}_{\mathbf{zy}}], \qquad \text{where } \theta = \sigma_\varepsilon^2/[\sigma_\varepsilon^2 + T\sigma_u^2].$$

Since the RE estimator is the efficient estimator when its assumptions are satisfied, but it is inconsistent when assumption (3'a) holds. Using a Hausman-Test, it is possible to compare it

[17] Gupta et al. (2004) use a GMM estimator and report that the weighting matrix allows for possible autocorrelation. However, they report just that their standard errors for inference are heteroskedasticity-consistent. Since the efficient weighting matrix is based on the asymptotic covariance matrix, it seems likely that also the standard errors allow for autocorrelation.

with the FE estimator, which is always consistent but possibly inefficient, since it sets $\theta = 0$. This procedure has been used by Collier (1999) and others.[18]

Given that the techniques described above are basic for any panel data model, it is surprising that not all studies control for these effects. Several studies, such as Gupta et al. (2004), just control for continent or region-fixed effects, which may fail to eliminate the problem of unobserved heterogeneity completely.

4.1.3 Simultaneous causation

Different from the problem of unobserved heterogeneity is the problem of simultaneous causation. Consider the following example: When income rises due to an unexpected shock to productivity, people might feel less inclined to engage in a violent conflict that endangers the productivity increase.

Formally, we can represent this in the framework outlined in the introduction as a correlation between one or more explanatory variables and the error term. That is assumption (3) fails because some explanatory variables are endogenous. Then the pooled OLS estimator becomes inconsistent.

The way out is to use a prediction of the endogenous variable that is uncorrelated with the error term. To do this, it is necessary to find one or more "instruments" $\mathbf{q}_{it}$ that are valid, that are uncorrelated with the error term, $E(\mathbf{q}_{it}\boldsymbol{\varepsilon}_{it})=\mathbf{0}$, and that help predicting the endogenous variable. That is, they are relevant: $E(q_{it}^{(g)}\mathbf{z}_{it}')\neq\mathbf{0}$ is required for all components of $\mathbf{q}_{it}$, that are not included in $\mathbf{z}_{it}$. Notice that $\mathbf{q}_{it}$ may include the exogenous components of $\mathbf{z}_{it}$. Then we can write $\mathbf{z}_{it} = \mathbf{q}_{it}'\delta + \upsilon_{it}$. Using OLS to estimate δ and then predicting $\mathbf{z}_{it}$ provides exogenous regressors, which can then be used in (2).[19] This is known as Two-Stage Least Squares (2SLS) or Instrumental Variables (IV) estimation.

Several problems may arise, even when the IV estimator is used. First, all potentially endogenous variables have to be instrumented to avoid inconsistent parameter estimates of all

[18] An alternative to the Hausman-Test and a different approach to cope with unobserved heterogeneity was developed by Chamberlain and involves including country-averages over time as additional regressors and testing for the significance of their coefficient. In the present context, however, this seems inappropriate because the coefficients are likely to be inconsistent. Even when current wars are unrelated to current development, it seems most likely that past development indicators are related to current conflicts, which would introduce an endogeneity problem.

[19] For statistical inference, the standard errors have to be adjusted to account for the additional uncertainty as one regressor is generated with a prediction error.

coefficients. Second, using weak instruments, i.e. those only weakly relevant so that $E(q_{it}^{(g)}\mathbf{z}_{it}')$ is different from but close to zero, may cause again inconsistent parameter estimates in finite samples or in the presence of not perfectly valid instruments (Bound et al., 1995; Shea, 1997). Third, the assumption of validity of the instruments should be tested by employing more instruments than necessary and then evaluating the sample analogue of $E(\mathbf{q}_{it}\mathbf{z}_{it}')$ using a Sargan-Hansen test. Neither of these problems has been addressed in the literature reviewed for this article.

Even endogeneity issues in general have been addressed only by some authors. Hess (2003) conducts his empirical estimates using the full sample and obtains, therefore, potentially biased estimates of coefficients. His check for "endogeneity" by omitting some of the forecasted observations in the cost calculations in a later stage cannot correct for this potential inconsistency since all the remaining forecasts are also inconsistent. Koubi (2005) addresses endogeneity by throwing away the observations for the first period in countries which experienced a conflict in both of his sub-periods. Thus, he introduces a sample-selection on a potentially endogenous variable instead of curing the endogeneity problem, although he properly instruments other potentially endogenous regressors. Kang and Meernik (2005) do instrument for conflicts. They use agricultural growth, urban population, tropical location, and a dummy for the post-Cold War era to instrument for conflicts. They do not, however, model the endogeneity of foreign aid or investment. In general, it has to be said that it is not sufficient to instrument one endogenous variable but that all potentially endogenous variables have to be instrumented. It seems, therefore, fair to summarize that the existing literature does not address the problem of endogeneity in a satisfactory way.

Considering endogeneity is also important, since it can be caused by omitting relevant explanatory variables. For example, Collier (1999) motivates his analysis of the growth effects of civil wars through a model of investment and omits investment in his growth equation. To the extent that investment is not entirely determined by conflicts, but correlated with both, conflicts and growth, this causes the standard estimator to be inconsistent. The alternative, however, the inclusion of investment, would mean that the effects of conflict are analyzed for a given level of investment. Holding investment constant in presence of a conflict fails to capture indirect effects of conflict on growth and will, therefore, understate the true causal effect. While some authors, e.g. Easterly et al. (1993), analyze in a separate regression the effects of conflict on other explanatory variables, this procedure is inefficient.

Intuitively, estimating the equations separately neglects information about the joint distribution of error terms. Moreover, it might in turn lead to inconsistent estimates due to omitted variables or simultaneous causation.

Estimating systems of equations circumvents the problem of either omitting relevant regressors or capturing only partial effects of conflicts. Gupta et al. (2004) solve this problem by modeling the indirect effects of conflict simultaneously and explicitly. When indirect channels are considered to be important, estimation of a system of equations becomes necessary. Estimation of such a system requires some "exclusion restrictions", which means that there must be some explanatory variables that affect just one of the variables whose behavior is modeled but not the other(s).[20]

4.1.4 Sample selection problems

Frequently, the data for countries prone to conflicts is missing. Ignoring the problem of missing data can have two consequences. First, it can cause parameters to be inconsistent. Second, it can cause inefficient parameter estimates because not all available information is used.

Assume for simplicity that if data is missing, the regression for none of the indicators of development can be estimated. Specifically, let *d* denote a censoring indicator which takes the value of 1 when not all variables necessary for estimation are observed:

$$d_{it} = \begin{cases} 1 & \text{if at least one element of } (\mathbf{y}_{it}, \mathbf{x}_{it}, w_{it}) \text{ is missing} \\ 0 & \text{otherwise} \end{cases} \qquad (9)$$

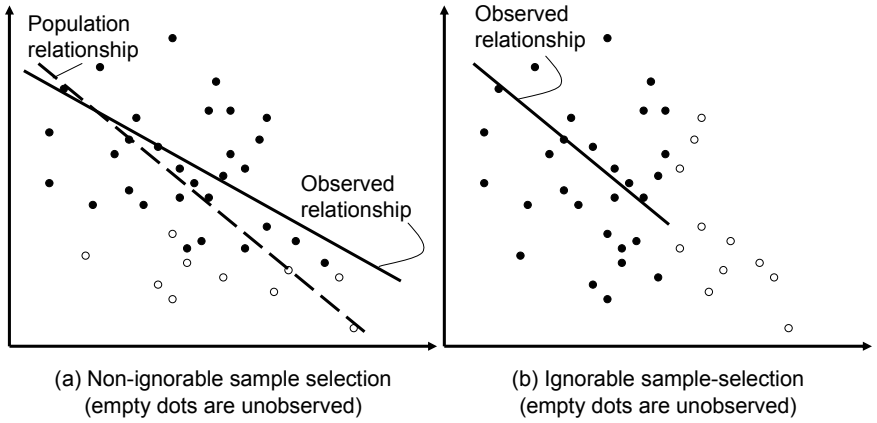
The crucial question concerning the problem of consistent estimators for parameters is now: Is the sample selection problem ignorable? The answer depends on the factors influencing *d* and whether these are possibly endogenous.

When the sample selection depends on some endogenous variable, then it is non-ignorable. Consider the case illustrated in Figure 4-1. Assume it depicts the relationship between severity of conflict and growth. In the left graph (a), it is assumed that when growth is particularly low, the observations are likely to be missing. It is easy to see that this will distort any regression analysis based on observed data only. Since "bad" outcomes are unobserved, the effect of conflict seems less pronounced.

[20] Instrumental Variables estimation is, in effect, estimation of a system of equations without attempting to model explicitly the causal effects on the instrumented variable. This is because only a consistent predictor is required.

In contrast, in the case illustrated in (b), observations are missing if conflict was particularly severe – and conflict is assumed to be exogenously caused. In this case, there is no problem. The observed regression coincides with the population relationship, at least for a large enough sample size. Such a well-behaved sample-selection would, however, not be possible if low growth caused more severe conflict.

Figure 4-1
The effect of non-ignorable sample selection



Formally, sample selection is ignorable if $E(\mathbf{y}_{it} \mid \mathbf{x}_{it}, w_{it}, d_{it}=1) = E(\mathbf{y}_{it} \mid \mathbf{x}_{it}, w_{it}, d_{it}=0) = E(\mathbf{y}_{it} \mid \mathbf{x}_{it}, w_{it})$. Since conditional on $(\mathbf{x}_{it}, w_{it})$, all elements of $\mathbf{y}_{it}$ except the error term are known, the criterion for ignorable-sample selection is:

$$E(\boldsymbol{\varepsilon}_{it} \mid \mathbf{x}_{it}, w_{it}, d_{it}) = E(\mathbf{y}_{it} \mid \mathbf{x}_{it}, w_{it})$$

A sufficient condition for this to hold is when sample selection, as depicted above in case (b), is a deterministic function of the regressors $(\mathbf{x}_{it}, w_{it})$ – in that case, d_{it} contains no additional information and has not to be taken into account. Also, if selection is purely random, that is unrelated to both $\boldsymbol{\varepsilon}_{it}$ and the regressors, there is no problem.

When selection is non-ignorable because it depends on $\mathbf{y}_{it}$ then consistent estimation requires estimating a system of equations with a binary model for the probability of sample selection (i.e. a probate model to model d_{it}) in addition to the regression(s) in equation (2), which is

commonly known as the Heckman model.[21, 22] In practice, this requires finding additional determinants of sample-selection which do not determine $\mathbf{y}_{it}$. In case of sample selection depending on a possibly endogenous regressor such as a conflict indicator w_{it}, a combination of the Instrumental Variables procedure outlined above and the Heckman model for sample selection depending on $\mathbf{y}_{it}$ can be applied. In both cases, the procedure amounts to including the inverse Mills ratio as an additional regressor in (2). The inverse Mills ratio represents the expected value of the error term in the selection equation conditional on the variables being observed. Testing for the significance of this additional regressor is a test of the Null hypothesis that sample selection is ignorable.[23]

In the existing literature on the effects of conflict, the sample selection problems have been mostly ignored. Imai and Weinstein (2000) address sample selection by imputing missing data points. Imputation of data means that missing values are replaced by artificially generated values drawn repeatedly from an estimated distribution. Then, the estimation is performed repeatedly for each set of imputed data points and for the given set of observed values. Then, parameter estimates are averaged over the different estimates and standard errors, which account for both between-imputation and within-imputation variability. Imputation techniques with adjusted standard errors have also been occasionally used in other econometric growth studies. Hoover and Perez (2004) apply it to the dataset analyzed by Sala-i-Martin (1997) and point out that 14.5% of all data points in 25% of the countries are missing. They use the algorithm proposed by King et al. (2001).

Problematic with data imputation is that it produces only consistent results if the sample-selection is ignorable. Thus, one could argue that also the (conflict and) growth studies using multiple imputation do not represent an improvement over the remaining studies. However, Schafer and Graham (2002) argue that in the absence of very strong endogeneity of the

[21] It is possible to model the selection equation not in a binary but as a function of a variable which is truncated at zero. This Tobit selection equation requires that the truncated variable is always observed (cp. Wooldridge, 2002, 571f.).

[22] Complications arise when the selection process also depends on the panel structure, e.g. because of unobserved fixed effects and dependence on lagged dependent variables. Schafer and Graham (2002, pp. 171f.) briefly discuss this literature.

[23] When the Null of ignorable sample selection is rejected, the standard errors of the regression have to be adjusted or the model has to be re-estimated using a simultaneous procedure which requires stronger assumptions. The validity of the test is, nevertheless, conditional on the correct functional form assumption for the selection process and might be sensitive to specific functional form assumptions (Schafer and Graham, 2002).

variable which causes the missingness the bias is only of a small magnitude, and imputation methods should be the preferred to other methods.[24]

Even when one assumes, as Schafer and Graham (2002) suggest, that the bias because of endogeneity can be neglected, multiple imputation techniques might still be preferred to simple regression models. While, as argued above, simple regression models remain consistent, they are inefficient as they fail to use all available information. Imputation is viable since the observed data contains some information about the missing data. Not using this information is inefficient and might lead to broader confidence intervals for parameter estimates. To provide precise estimates of costs of conflict and provide policy advice, it might be desirable to incur the cost of multiple imputation to reduce the uncertainty of estimates.

4.1.5 Additional approaches

Two main approaches in addition to the standard cross-country regression framework outlined above are important in the context of this report: Event study techniques and single-country time-series or micro-data models.

Event study techniques transform the data into event-time before analyzing them. This means that the data is no longer chronologically ordered but ordered in time before and after an event – here the data would be ordered in periods before and after conflict or the onset of conflict. Then, either traditional econometric techniques as outlined above or non-parametric techniques can be applied. Non-parametric techniques include, for example, the comparison of medians of conflict and non-conflict countries. In principle, they should yield the same results as models based on chronologically ordered data. Chen et al. (2007) use them mainly to describe the typical pattern of development in conflict countries rather than to identify causalities. Abadie and Gardeazabal (2003) analyzed the link of terrorist attacks and the development of the stock exchange the following days.

Using single country models for time series data or micro data has the draw-back of not using all available information in the cross-section. It may, nevertheless, serve to validate cross-sectional findings. Most importantly, more detailed data may be available. Soares (2006) uses

[24] Apart from the regression-based models (e.g. the Heckman model) also weighting is possible. This technique is mainly used for survey data. In principle, weighting allows to correct for a bias due to missing data in the sample by population-based weighting or weighting with the inverse of the response probability and the selection probability. However, in the context of cross-country studies this methodology seems hard to apply since either the probability of the data to be missing had to be modeled or an underlying population would have to be identified.

Brazilian micro-data to analyze how important factors, which had to be neglected in the cross-section because information was unavailable, are. Often, cross-sectional data especially for developing countries is only available on an annual basis. Single-country time-series models might be able to exploit higher frequency data in order to assess dynamic effects of conflict in greater detail. Single-country studies might also allow to assess whether the assumption of homogeneous parameters across countries, which is implicit in all regression models discussed above, is justified (Lopez/Wodon 2005). To that aim, it might be possible to use detailed micro or time-series data for several countries separately.

In single-country studies, accounting methods are also frequently used. They aim at accounting for damaged and destructed assets and are easily understood. However, although transparent along their methodology and the basic theoretical assumptions, accounting methods are not sufficient to capture the comprehensive costs of mass violent conflicts as they do not recognize the consequences of the conflict-related damage and are, therefore, never used on their own (e.g. Richardson/ Samarasinghe 1991; Arunatilake, Jayasuriya, & Kelegama 2001; Dorsey & Opeitum 2002). In the present context, they are possibly useful to provide additional data not available in macro-databases and to identify channels which should be included in structural regression models.

In Table 4–1, which follows, an overview of all empirical studies, which analyze the effect of major conflicts in a cross section of countries and were surveyed for this report, is given. The lack of incremental innovation is remarkable – most studies are based on some innovation compared to the simplest possible model but without using an encompassing methodology.

Table 4-1
Methodological overview of cross-country studies

Author(s), Year	Dependent variable(s)	Methodology					
		OLS	FE	GLS	IV	Dyn	Other
Easterly et al. 1993	GDP growth	x					
Barro and Lee 1994	GDP growth	x	x		(x)		
Sala-i-Martin, 1997	GDP growth	x					Robustness test using modified extreme bounds analysis
Collier 1999	GDP growth	x	x	x		x	
Imai and Weinstein 2000	GDP growth	x	x	x		x	Missing data imputation
Ghobarah et al. 2003	Life-expectancy (disability-adjusted life- years)	x					cross-sectional analysis only
Hess 2003	Consumption growth and volatility		x			x	Partial equilibrium welfare analysis
Hoeffler and Reynal-Querol 2003	GDP growth / Infant Mortality	x					
Collier and Hoeffler 2004	GDP growth	x				x	
Guha-Sapir and van Panhuis 2004	Mortality						Meta-analysis
Gupta et.al. 2004	GDP growth, military expenditure, revenue	x			(x)		simultaneous equation system
Murdoch and Sandler 2004	GDP growth	x				x	
Kang and Meernik 2005	GDP growth				x		
Koubi 2005	GDP growth	x			(x)		
Chen et al. 2007	Various measures of human development	x	x			x	Descriptive event study
Lai and Thyne 2007	Education: expenditure and enrollment	x				x	model auto-correlation in residuals.

Notes: OLS – Ordinary Least Squares with or without time and region/continent fixed effects; FE – country fixed effects; GLS – Generalized Least Squares; IV – Instrumental Variables estimation, (x) refers to studies instrumenting only variables other than conflict indicators; Dyn – some modeling of dynamic effects.

4.2 Evaluating Causal Effects

4.2.1 Analyzing aggregate Welfare I: Applied Partial equilibrium analysis

When the problems of identifying causal effects of conflict on different indicators of human development are solved, the question remains how two different indicators, say life expectancy and income, can be compared. Quantifying the aggregate cost of conflict requires taking a stance on what matters for human welfare. Expressing human welfare in a single number requires a functional form for welfare over the relevant development indicators. This implies making strong assumptions about human preferences.

In theory, it is possible to allow for a variety of welfare criteria. A standard result from the early literature states that it is impossible to aggregate individual preferences of arbitrary form (Arrow, 1950). In the Political Economy literature, it is therefore common to assume certain forms of preferences that can be calculated. Standard macro welfare analysis usually ignores these problems and assumes the existence of a representative agent, e.g. a household, a consumer, or firm, with well-defined preferences. This agent is then assumed to act optimally, that is to choose her actions so as to maximize her welfare function.

The two approaches taken in the literature outlined above are typical for this type of analysis. Both stipulate the existence of a representative agent with a certain type of expected utility function over life-time consumption.[25] In particular, they assume that agents' utility is characterized by a certain form of risk-aversion, i.e. agents prefer a certain consumption value with certainty strictly over an entitlement to uncertain consumption, which on expectation yields the same consumption value.

In these models, welfare is defined as the (weighted) utility of optimizing agents. Since consumption is measured in monetary terms (at constant prices) and yields a certain utility, the effects of other factors affecting utility can be quantified as "consumption-equivalent" and thus be expressed in monetary terms. In Hess (2003), conflict causes consumption to be uncertain. As households dislike uncertainty, they are willing to give up some consumption permanently for the rest of their lives to live in a less uncertain world. Soares (2006) assumes that violence affects life-expectancy and, thereby, the life-time. As utility is defined over the

[25] The representative household or consumers maximizes $U_0 = E_0[\Sigma_t \beta^t u(c_t)]$ subject to some constraints. $\beta<1$ is the discount factor, t denotes time-periods (over a life-time or the infinite future) and c_t denotes consumption in a given period. The instantaneous utility function (also called felicity function) u(.) is usually defined assuming constant relative risk aversion: $u(c) = (c^{1-\gamma} - 1) / (1-\gamma) + \alpha$. Here, γ denotes the coefficient of relative risk aversion and α is a constant.

entire life of a person, extending the (expected) life-time by a small amount yields a marginal utility benefit which can be computed. Then, the equivalent consumption value to achieve this benefit can be calculated. Both studies consider only the partial equilibrium model as they model only some factors influencing consumption decisions within a given country. In principle, both analyses could be merged and extended to further – e.g. to allow for different choices of technology, restricted choice sets, international spillovers, etc.

The benefit of quantifying welfare effects comes at the cost of specific assumptions: the functional form, as well as the parameters characterizing it, have to be assumed. Empirically, these functional form assumptions have been challenged.[26] Additionally, the results are potentially sensitive to the specific assumptions made and might even vary substantially with the parameters employed.

An alternative is to focus on a single indicator of human development or to analyze the different dimensions separately. Under the assumption that conflict does not enhance any dimension of human development, a single indicator can be seen as giving a lower bound of the costs of conflict. Simply stating the effects along several dimensions of development costs today and in the future can also be considered an agnostic way to empower the reader of the results to form her own judgment about the welfare implications. While this solution is clearly not entirely satisfactory, it is less controversial and more robust to model uncertainty than functional form assumptions made in parts of the literature.

A sort of compromise between the specification of the utility function to compute aggregate welfare costs and the simple disclosure of a predicted time-series of current and future development costs is to compute a present value cost for each indicator. That is, by choosing an appropriate discount-factor for future costs, which could be chosen from the models utilized above, one could compute a discounted sum of current and future development losses because of conflict.

4.2.2 Analyzing aggregate Welfare II: Applied General equilibrium analysis

A natural extension of the welfare analysis in partial equilibrium is to ask: What are the effects of war on decisions other than consumption decisions? Extending the analysis from a partial model of the economy, i.e. only consumption decisions, to the entire economy and

[26] Cp. the literature on its application in stock market pricing, e.g. Mehra and Prescott (2003).

calibrating it to real world data allows us to answer this question. This is important for the literature on the costs of conflict, since it has been made clear in chapter 3 that conflict has a potentially large impact on the production side of the economy through various channels and is likely to have international spillovers. Although more complex in methodology, it is clearly desirable to account for these factors explicitly rather than neglecting them and assuming that they are of negligible magnitude.

Applied general equilibrium models, also known as Computable General Equilibrium models (CGE), have a long tradition in the Economics literature and have been increasingly popular in recent years, partly because of increased computing power (cp. Kehoe and Prescott 1995). These models describe typically one or several national economies, which in turn consist of consumers, producers, and possibly a government. Producers, possibly as well as consumers, can be heterogeneous, e.g. a distinction by different sectors of production is made. Consumers might be modeled as described in the partial equilibrium model above. However, they might be assumed not only to provide savings but also to pay taxes and supply labor. Firms and consumers are rational agents and optimize their objective functions, the present value of their profits and life-time utility, respectively. Similar to the partial equilibrium model described above, these models provide a straightforward measure of welfare: the life-time utility of the consumer. Different policies or other scenarios can then be evaluated by computing the amount by which the representative consumer's income would have to change to maintain the same utility as in the benchmark case – this is called the equivalent variation. Typical applications of such models include the assessment of different tax or trade regimes and policy consequences in business cycle models. This is achieved by first calibrating the parameters of the model so that the baseline case resembles the important features of the observed data as closely as possible. Common practice is, however, to set some parameter values a priori based on empirical estimates in previous studies (cp. Kehoe and Kehoe 1994, Kehoe and Prescott, 1995, Bayar et al. 2000, Altig et al. 2004).

For modeling the costs of conflict, two different but non-exclusive families of models represent a natural starting point: multi-national models of international trade and dynamic stochastic general equilibrium (DSGE) models used in modern macroeconomics. Multi-national models of international trade are usually based on a number of countries or regions each of which contains several sectors of production. Consumers are usually assumed to have a preference for a variety of consumption goods but with a bias for home-produced goods.

The combination of these two assumptions allows us to model empirically-observed trade flows more closely.[27] Effects of policies can be modeled through changes in tariff rates or taxes on capital or labor income. Other scenarios could be to introduce shifts in the productivity of specific sectors within one or several countries. One important advantage of multi-country models is that it is possible to disaggregate welfare effects by each region (or country) included in the model.[28]

While the analysis of trade policy is sometimes carried out by introducing a policy change that was considered a zero-probability-event by agents, modern macroeconomics is based on stochastic models, which consider productivity as a random variable. In this class of models, agents take account of the uncertainty involved in future decisions, although it is common practice to neglect effects of the variance by simply solving a linearized approximation around the equilibrium. However, these models are usually used to analyze shocks that occur at business cycle frequency such as government spending or oil-price increases. Since these shocks take place at quarterly or at most yearly frequency, this class of models is perhaps better suited to model terrorist attacks than longer-lasting events such as civil or internationalized wars.[29] DSGE models for international phenomena also model usually small open economies but not the world economy as a whole. For analyzing the costs of conflict, it might, therefore, be easiest to extend multi-country models used for trade policy analysis by explicitly introducing stochastic variables.

As a guideline for including variables in a CGE model of conflicts, empirical estimates as described above should be used. Ideally, a research strategy such as that by Altig et al. (2004) for macroeconomic policies should be adopted. First, they carefully identify the dynamic responses of the US economy to a monetary policy shock and two technology shocks and then estimate model parameters so as to match as close as possible the identified causal effects of the three shocks. Their methodology even allows making statements about the significance of the differences between the model behavior and that of the real data. In the present context, this would imply to use the methodology outlined in section 4.1 to identify causal effects and

[27] This bottom-up approach seems preferable in the present context to top-down approaches which model a single economy and then disaggregate the effects into several regions assuming certain production technologies based on input-output matrices (Dixon and Rimmer 2003).

[28] Introducing heterogeneous consumers would further allow to disaggregate the effects to allow for a differential impact on different types of households.

[29] Apart from Hess (2003), all cross-country studies filter out effects of wars at business cycle frequency by basing their estimates on data averaged over several years. In contrast, Nordhaus (2002) in his single country study models both long-run and short-run (business cycle) effects of the Iraq war in the USA.

then choose the parameters of the CGE model to replicate these effects. For example, estimating a model of simultaneous equations that include different sectors and investment with dynamic effects of conflicts provides a benchmark of how different sectors in a typical economy respond to a typical conflict. Supplementing this with estimates of the behavior of agents (households and firms) in conflict-affected countries would ideally provide the information needed to identify the parameters of a CGE model of conflicts. Practically, it is likely that some parameters are still unidentified so that they have to be set ex ante on basis of the existing general literature on CGE models.[30]

Similar to the applied partial equilibrium models, the advantage of allowing a precise welfare analysis of the elimination of armed conflicts in CGE models comes at a price. First, choosing the dimensions of the real world data along which the researcher wants the model to fit is arbitrary. Second, all statements are conditional on the assumed functional forms of the model. Third, in order to provide a comprehensive welfare analysis, the costs of conflict prevention would have had to be included, an issue neglected in the present study.

5 Evaluation III: Data

Evaluating the different datasets serves several purposes. First, it shows whether a comprehensive cross-country study is feasible. Second, it indicates whether sample selection problems, as discussed in section 4.1.4 are a quantitatively important feature of the data. Third, it indicates whether it is likely that there is substantial measurement error in the data.

Measurement error in the endogenous variables matters only insofar as it may introduce heteroskedasticity in the error terms. As has been argued above, virtually all studies allow for heteroskedasticity so that this issue does not represent an additional challenge. If at least one exogenous regressor is measured only with error, and this error is independent from that of the endogenous variable, this will make any estimate of its coefficient inconsistent. When only one variable is measured with error, its coefficient estimate will be biased towards zero with unknown effects on the remaining variables (cp. Durlauf et al., 2005).[31]

[30] Therefore it is important to assess how well the CGE model fits the real world data: either by the methodology applied by Altig et al. (2004) or by the simpler and more common technique of comparing correlations of the predicted data with real world data.

[31] Endogenous regressors which are properly instrumented and if the measurement error is uncorrelated with the instruments do not cause problems.

5.1 Datasets: Conflict

The global evaluation of effects of conflict relies crucially on the general availability of data. For the past forty-five years, different data projects have tried to capture conflict-events. However, until now, there is no consensus on the operationalization of mass violent conflicts, and results differ significantly (cp. Chojnacki/Eberwein 2001). This is not (just) the consequence of scientific rivalry, different theoretical assumptions and methodological constraints, but a consequence of political-historical developments, too. We focus on the two most comprehensive and widely accepted data sets and add three further interesting data sets. Additionally there exist several data set projects which we will not consider at first place, either for content reasons (conflict as just one aspect), methodological reasons, and/or their missing reputation: Minorities at Risk (www.cidcm.umd.edu/mar/); KOSIMO (www.hiik.de/kosimo); AKUF (http://www.sozialwiss.uni-hamburg.de/publish/Ipw/Akuf/index.htm); FORK (www.fork-berlin.org/daten.htm).[32]

5.1.1 Correlates of War Project

The Correlates of War Project (COW - www.correlatesofwar.org) is the most senior data project on mass violent conflicts. It started coding of interstate wars since 1816 in 1963 at the University of Michigan and is continued as COW 2 at Pennsylvania State University since 2001. The project developed some core definitions and assumptions, which lasted as a guideline for several decades. The key operational criteria require that at least one of the concurring parties be a member of the international state system.[33] What follows is a first distinction between interstate wars and intrastate wars. Additionally, the category 'extra-systemic war' does capture anti-colonial struggles (Singer and Small 1982). A reorganization of the typology differentiated intra-state conflicts into three types to adept to new historical developments (Sarkees 2000):

a. 'Civil war for control of central government'
b. 'Conflict over local issues'
c. 'Inter-communal conflict'

[32] Several analyzed studies in this project refer to SIPRI, the Stockholm International Peace Research Institute as their source. However, SIPRI again does just compile data from other data sources like UCDP/PRIO. Therefore we do not list SIPRI as an own source.

[33] That is the political entity has to have more than 500.000 inhabitants and either is part of a global intergovernmental organization like the United Nations or/and is recognized by at least two major powers.

Although the differentiation of (a) and (b) is disputable (cp. Chojnacki 2006), the introduction of the category of 'inter-communal conflict' is an important step to capture mass violent conflicts, where no state actor is involved.

What remained constant in the COW-operationalisation criteria is the threshold of at least 1,000 battle deaths per annum for a conflict to be included into the data set.

5.1.2 UCDP/PRIO Armed Conflict Dataset

The Uppsala Conflict Data Project at the International Peace Research Institute, Oslo (UCDP/PRIO - http://new.prio.no/CSCW-Datasets/) has presented data since 1993 and covers a range from 1945 until the present. It does add an additional category to capture intra-state conflicts, labeled 'internationalized armed conflicts'. Additionally the UCDP/PRIO does disaggregate the death-threshold and introduces three types of intensity: the highest intensity remains on more than 1,000 battle deaths per annum, the next intensity level regards 25-999 battle deaths per annum and additionally a total number of deaths during the conflict of at least 1,000. And a low intensity level armed conflict with 25-999 battle deaths per annum and a total number of battle deaths under 1,000. The UCDP/PRIO dataset is constantly updated and therefore helpful for the purpose of a yearly calculation of costs of mass violent conflicts.

5.1.3 Other Datasets

State Failure Project (http://globalpolicy.gmu.edu/pitf/): According to dataset tests, the state failure project does just cover a part of mass violent conflicts (Chojnacki/Eberwein 2001) and is therefore not able to fulfill our needs. However, it offers two advantages in respect to the more prominent data sets: a) it does include fight-related killings of civilians, and b) numbers on the spread of violence. Therefore, a combination of data sets could be helpful for tests and in some cases, to gain specific information on coefficients.

International Country Risk Guide (www.prsgroup.com/): This is a commercial data set. It combines different aspects of political risks including mass violent conflicts on a broad range of 12 different aspects of political risks and therefore can be used to discuss several dimensions of mass violent conflicts. It is used by some of the analyzed studies (Collier/Hoeffler 2004; Gupta et al. 2004).

International Crisis Behavior (http://www.cidcm.umd.edu/icb/): This dataset offers disaggregate data on crisis characteristics, geography, international involvement, mediation

and outcome. However, this dataset only covers inter and extra-states and is, therefore, not helpful for our purpose.

5.1.4 Findings and Gaps

Concerning the data sets on conflict we can distinguish several challenges.

a) **Update of conflicts**: the generation of a dataset is highly working intensive. Having a constantly updated dataset is therefore just to be expected from large and financially strong projects;

b) **Death tolls**: the big datasets (COW, UCDP/PRIO) provide battle death tolls. However, case studies point at the key role of the 'deliberative civilian victimization' and 'organized units of combatants […which…] are not sufficiently separable from the civilian population' (Chojnacki 2006). These conflict-related deaths are not included into the two big datasets;

c) **Onset and duration**: during the debate on war causes labeled "greed vs. grievance" (Ballentine/Sherman 2003), the discussion highlighted the challenge to distinguish ongoing mass violent conflicts in conflict-ridden countries from previous conflicts. The single-country studies (cp. section two) showed similar problems for our debate. Calculating costs out of the duration of conflict does make it crucial to get the right time ranges, which is further important to calculate peace-periods (cp. Suhrke et al. 2005).

d) **Scale**: another challenge is the spread of conflict over a country (Imai/Weinstein 2000). The Task Failure Project does account for it, with the mentioned problem of incomprehension of this dataset.

e) **Kind of warfare and war economy**: existing datasets do not account for different types of warfare and war economies (centralized command structures vs. loosely affiliated semi-criminal structures; mining economies, drug economies, Diaspora financing etc.). Here, further information would be helpful to calculate differences on the costs of conflict.

5.2 Datasets: Economy

5.2.1 Penn World Tables

The Penn World Tables mainly contains data on real GDP per capita and its different components and its main components from the expenditure side (consumption, investment, government shares) as well as price-indices and openness for 188 countries from 1950 to 2004, neglecting missing observations. The GDP data is constructed with the aim of comparing international standards of living by adjusting for purchasing power differences across countries (Feenstra et al. 2004).

While the construction of the dataset makes it useful to assess relative living standards, it has been criticized as an imprecise measure of changes in living standards, i.e. economic growth. Additionally, earlier versions of the dataset have been criticized for data uncertainty (Temple, 1999). Lastly, the expenditure concept employed in the study deviates from the theoretical measure of output as suggested by theoretical models (Feenstra et al., 2004). Despite this criticism, the dataset is one of the most frequently used data sources and results based on it therefore lend themselves comparisons with existing studies. However, while the Penn World Tables are still updated, the updating does not take place on a regular basis.

5.2.2 World Development Indicators

The World Development Indicators (WDI) are provided on an annual basis by the World Bank. It draws directly from national statistics but also on data provided by other international organizations. The WDI covers a broad range of indicators for most countries in the world.[34] Since it relies on data provided by other agencies, the WDI sometimes have missing data compared to the Penn World Table. Therefore each version relies on included estimates for data which is not otherwise available. Additionally, not all indicators are updated annually. Inequality indicators, for example, are only available on an irregular basis.

According to the primary data documentation of the WDI, the data sources and quality does vary across countries. Developing countries generally do not provide data based on the most recent (1993) System of National Accounts, but use the older versions dating from 1968 or 1953. Official exchange rates needed for conversion of national statistics are often replaced

[34] Some countries such as Taiwan (China) are missing.

by alternative conversion factors during periods of conflict. This occurs because of diversions of the official from the effective exchange rate.

The database is updated annually and contains data for 226 economies on up to 700 indicators starting in 1960.

5.2.3 Informal Economy

A major problem of the statistics is when the possible mismeasurement of economic indicators or, more generally, indicators of human development is correlated with conflict characteristics. Several definitions for the informal economy exist. One definition explicitly defines the size of the shadow economy as the value of those activities that should be included in GDP estimates but are not (Schneider and Enste, 2000). Apart from reasons in the legal system such as the tax code or social security system, "the decline of civic virtue and loyalty towards public institutions combined with a declining tax morale" (Schneider and Enste, 2000, p. 82) is one of the main causes of an increasing informal economy. This corresponds closely to the definition of conflict as applied in the present paper and illustrates that it can be expected that conflict and the size of the informal economy are positively correlated.

The informal economy can be treated as a measurement error. If the true model for GDP growth includes the informal economy, then we can observe the true indicator only with a measurement error which is correlated with conflict characteristics. When conducting regression analysis, this introduces a correlation between the error term and the regressor.[35] As outlined above, this requires to instrument conflicts in regressions explaining GDP growth or related variables. However, it may be more difficult to find valid instruments. Kang and Meernik (2005) use, among other variables, agricultural growth and urban population as instruments for the conflict variable. Yet, it seems reasonable to assume that these variables might be unrelated to measured GDP growth, but this might fail to hold for the size of the informal economy.

Apart from adjusting the regression model, other methods can be used to compute the unobserved size of the informal economy from observed indicators. Methods summarized as the "direct" approach use micro-level data, e.g. based on surveys or tax declarations.

[35] Let y_{it} denote observed GDP and $y_{it}^* = y_{it} + inf_{it}$ the true GDP including the informal economy. By assumption: $y_{it}^* = \mathbf{x}_{it}'\boldsymbol{\beta}_x + w_{it}\beta_w + \varepsilon_{it}$. Thus $y_{it} = \mathbf{x}_{it}'\boldsymbol{\beta}_x + w_{it}\beta_w + \varepsilon_{it} - inf_{it}$. Since we assume that conflict characteristics w_{it} is correlated with inf_{it}, there will be a simultaneous causation problem. If w_{it} is orthogonal to the remaining regressors, this will cause the estimates of βw to be biased downwards.

Problematic with this approach is that, since informal activities are often illegal, the micro-data obtained may be unreliable. "Indirect" methods use aggregate data to infer about the informal economy. These approaches include models, which used money or currency demand unexplained by formal activities and financial variables as informal economy indicators. Other models rely on physical input consumption to infer about the level of both formal and informal activities. More advanced techniques conduct a factor analysis of several indicators to compute the unobserved informal GDP (Schneider and Enste, 2002). From these indirect methods, only those based on physical inputs seem least problematic in the case of conflict economies because of the excessive data requirements of other models.

5.3 Overall Data Availability

5.3.1 Inequality

A first project on conflict and inequality at DIW merges data from UCDP/PRIO and the World Income Inequality Database. When cumulated, we get 6719 total observations, 867 observations (or 12%) during war-time. From these war observations, just 145 (or 17%) provide Gini coefficients. In comparison, peace-observations offer 28%. For Africa, the data availability is worse, just 6% of war observations offer Gini coefficients, compared to 9% in peace-time.

5.3.2 Growth

For a growth comparison, we merged World Development Indicators and UCDP/PRIO data on conflict. To include human capital, we fix our time intervals on five years. Therefore, we get 850 observations in 150 countries from 1960 to 2000. Out of it, 70 countries are affected by conflict and provide at the same time available values for the control variables. These variables are: lagged growth and initial income; investment and inflation; and openness and school enrolment.

5.4 Datasets: Human Development

Data for human development are central for two purposes: a) to control for non-conflict-related influences on the economic development, and b) as proxies for channels of indirect influence of mass violent conflicts on economic costs. Next to a reduced survey frequency, disputed questions of definition and transparency are above all key problems.

5.4.1 Political Institutions – Polity IV

This does apply, for example, to the most commonly used measure on political institutions: the Polity IV data set (www.systemicpeace.org/polity/polity4.htm). It offers a 21-point scale from -10 to +10 to capture the quality of political institutions from 'fully institutionalized autocracies' to 'fully institutionalized democracies' in 162 countries from 1800-2006. Although still used in public terminology, contemporary science is quite skeptical concerning the assumption of a linear trend from autocracies to democracies, resulting from the first approaches of the transition debate. However, they additionally offer disaggregated data on characteristics of institutions (political recruitment; executive constraints, political participation) which can be included in an econometric model.

5.4.2 Civil Liberty – Freedom House

Freedom house is an organization which 'translates the intangible values of freedom into a strong tangible impact by combining analysis, advocacy and action' (www.freedomhouse.org). This combination of science and politics, plus a budget which is overwhelmingly sponsored by the US-administration, does let scientists be skeptical on the non-partisan quality of these data. Their advantage is the continuing actualization of their data set on 'Political Rights' and 'Civil Liberties' since 1972 for all countries. For the years 2006 and 2007, more disaggregate data are available (e.g. 'participate freely in the political process'; 'Vote freely in legitimate elections'; 'Have representatives that are accountable to them'; 'Exercise freedoms of expression and belief'; etc.)

5.4.3 Health – WHO

The WHO provides highly disaggregated data on 193 countries (http://www.who.int/whosis/database/core/core_select.cfm). The over 50 indicators cover 'mortality and burden of disease, health service coverage, risk factors, health system inputs, differentials in health outcome and coverage, as well as basic socio-demographic statistics'. However, they only do offer information on selected years, and, therefore, its usage for cross-country studies using panel regression analyses is restricted. Nonetheless, they can be used for more specific insights of the contemporary situation (cp. Ghobarah et al. 2003) A more ambitious project on homicide is forthcoming as part of the Global Burden of Armed Conflicts Report.

5.4.4 Education

Barro and Lee (2000) offer data on education (http://www.cid.harvard.edu/ciddata/ciddata.html). They provide data for 142 countries on primary, secondary, and tertiary educational attainment, as well as average years of schooling. Some disaggregation by sex and age group is provided. For 109 countries, at least one data-point in each five-year interval from 1960-99 is provided. Barro and Lee (2000), as well as Lai and Thyne (2007), discuss additional data sets.

6 Assessing the Costs of Conflict and Resulting Policy Implications

We start this chapter by developing proposals for estimating the costs of mass violent conflict in the first section. Then we assess in the second subsection whether these proposals can be readily generalized to include other forms of conflict not covered by our working definition in the remainder of our report. In the third and last subsection we suggest policy conclusions based on our evaluation of the existing research on costs of conflict.

6.1 Proposals for Estimating the Global Costs of Conflict

This part of the paper proposes a unified framework of analysis. The outlined proposals are based on the evaluation of content, methodology and data, by appreciating findings and gaps.

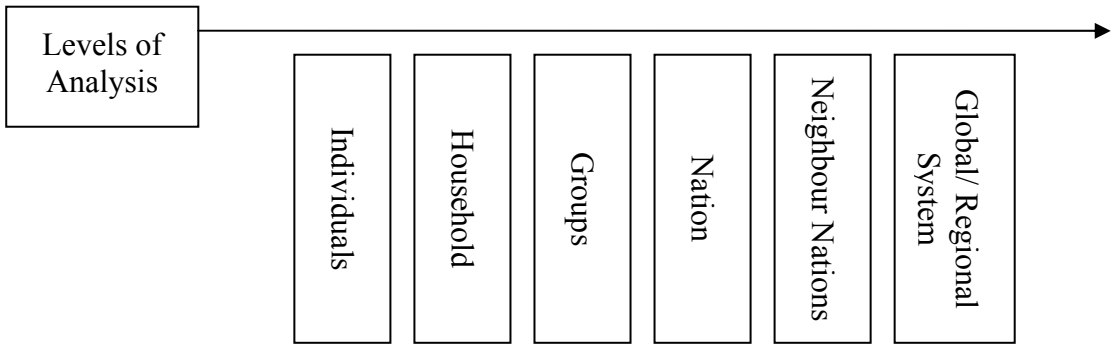
6.1.1 Dimensions

This includes the **dynamics of conflict**, i.e. the regarding of pre-war periods for non-conflict-related path-dependences, of the duration and of the aftermath of mass violent conflicts. Secondly, the **characteristics of conflict** are an important dimension, which has to be considered. This includes length, spread, and intensity of conflict as well as its type, i.e. the involvement of different legal parties (governments, rebels, outside states). Thirdly, we have to **control** for non-conflict-consequences-factors, like initial GDP. Fourthly, the interplay between aggregating and disaggregating data has to be regarded. We can disaggregate GDP (-growth) to evaluate the impact of **different channels** on the economic costs. This does include specific analyses on sectors (Collier 1999), health (Ghobarah et al. 2003) or education (Lai/Thyne 2007). The importance here is on the one hand to show that different groups in a conflict-ridden society are affected differently; and on the other hand to gain information

where policy advice could be efficient.[36] Additionally we can use disaggregated data of single-country and **micro-level studies** to fine-tune our models. A good combination of these two aspects can be helpful. Regarding **methods**, most of the analyzed studies use accounting, time series, or panel regression analyses. For our purpose, just the last one is feasible. However, the level of sophistication of regression analysis can vary. A qualitative break would be the usage of general equilibrium models, which additionally would allow as a stronger integration of the mentioned micro-level studies. These methods have to be saved by explicit **tests**. Finally, we can rely on existing **databases** and/or we can combine them. These combinations have to be tested, and if needed, additional work on them has to be done using data techniques. Finally, a central conceptual question, which was neglected by the previous studies, but is central for our task, has to be treated: the **level of analysis.** It is, therefore, treated extensively in a short excursus.

6.1.2 Excursus: Level of Analysis

Figure 6-1
Levels of Analysis



The previous cross-country studies focus on the national level. The single-country studies normally do not explicitly define their level, but regard either the national or some regional level. However, this is just one of several levels, and the task to calculate costs on a global and regional level pose this question centrally. This is not just a quantitative question of scope, but the levels do include qualitative breaks. On the lowest level, we can analyse the costs of mass violent conflicts for single **individuals**. However, economic analyses mostly

[36] E.g.: Even if the support of cash crops can lead to higher growth rates in the official statistics, this does not mean directly a general improvement of the most conflict-affected people. Therefore long-lasting policies to support the development of the poorest parts of society have to be conducted, which may be in conflict with short-term-growth-policies (Brück 1997).

start on **household** levels (cp. Brück 1997; Justino 2006). Next to losses because of destruction, we can analyze altered employment and income opportunities, as well as coping strategies. On the level of **groups,** we can analyze influences on social networks and local economic structures, its link to mass violent conflicts, and the consequent economic costs. Displaced persons are an example (Justino 2006). On a **national** level, we include more formal institutional structures, like the administration and politics. Additionally we can analyze international costs, resulting from (distorted) goods and capital transfer. On the next level we analyze the costs of a mass violence conflicts for **neighbouring** countries, including intervening countries.[37] The last level includes the whole **system** of countries of a region or globally. Here we do not just have to sum up the economic costs of every single country and the effects on neighbouring countries, but we have to integrate systemic costs like a general tightening of security measures, and more protectionist policies. And we have to differentiate net and gross costs. The costs for one country could be at least in part the benefit for other countries and subsequently the overall systemic net costs have to be decreased.[38]

Summarized these base questions, we can outline now several proposals in increasing order of complexity. They represent viable concepts to address most of the issues raised in the evaluation and presentation of the state of the art discussed in chapter 3 and 4. Just due to data restrictions and the need to focus on models which are feasible and comparable across a wide range of countries, a small amount of challenges could not be integrated.

6.1.3 Baseline Proposal

As a baseline model, we propose a real GDP per capita growth regression model, as among others used by Collier (1999). Nonetheless, we propose a series of alterations to provide more consistent and encompassing estimates of the costs of conflict. However, this model does not offer more scope for disaggregation other than GDP in growth-values and absolute values.

Level of analysis: This baseline model is estimated on the country level. To reach a global number of economic costs of mass violent conflicts, the single country costs are cumulated.

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[37] ‚Neighbour nation' would therefore not be defined solely on geographical contiguity. An example would be the costs of the mass violent conflict in Iraq for the intervening USA.

[38] An evident example is tourism: studies on Sri Lanka do calculate a high amount of costs because of reduced international tourism (Kelegama 1999; Arunatilake et al. 2001). However, these tourists do not stay at home, but just change their holiday destination. Nonetheless, we can assume, that a part of this benefit to other countries will be realized, as part of the people may decide to stay at home if their first choice is not available and/or a systemic spread of insecurity changes structures of the tourism industry.

As core **datasets** we propose the UCDP/PRIO dataset as it includes the most up-to-date conflict data as well as concrete numbers of battle deaths. We use the Penn World Tables for data on economic indicators and complement these with available data on education and institutions.

Estimation strategy: While the proposed model is of limited complexity, even this baseline model would represent a major improvement compared to the existing literature by encompassing most of the econometric models used so far and additionally controlling for neglected dynamics in the dependent variable.

To be precise, the model would be based on a transformation of the raw data into five year averages, to filter out variation at business cycle frequencies while maintaining a sufficient number of observations for each country. GDP growth per capita as the dependent variable is still likely to be correlated over time, so that the inclusion of its own lagged values as a regressor is warranted. This, together with concerns about the importance of unobserved heterogeneity governs the choice of the estimators. To control for time-effects, dummy variables for each period will be included.

For estimation, the following estimators will be used: (1) The Arellano-Bond system estimator because of its superior properties in large samples. (2) The within-group panel estimator, because of its possibly preferable properties in sample of limited size. Depending on whether or not the restrictions implied by the (3) generalized least squares estimator can be maintained, also the latter will be used.

To identify genuine effects of conflicts and to minimize the effects of omitted variables, we **control** for important growth determinants such as initial GDP per capita, investment in physical capital, education, openness, macroeconomic policy indicators (e.g. inflation, government debt) and institutional characteristics. At least investment and openness should be instrumented with its several lagged values to allow for simultaneous causation and test the exogeneity of all instruments using a Sargan-test.

Apart from these control variables, a richer set of **conflict characteristics** will be employed than is standard in the literature. First, to capture conflict characteristics, we include different types of conflict coded by the UCDP/PRIO dataset. Additionally, we include the ratio of battle-deaths to the total population to control for the intensity of the conflict and the length of conflict. Those measures which are significant and perform superior to a simple conflict dummy will be retained in the model. As an additional robustness check, conflict

characteristics will be instrumented, possibly using as instruments those proposed by Kang and Meernik (2005). When results change significantly, the instruments will be retained in the final specification.

To capture genuine **dynamic effects** of conflicts, several specifications will be tested. First, the significant conflict characteristics will be included with several lags in the regression. Testing up to which number of lags conflict characteristics significantly affect growth provides a first measure of dynamic effects. Depending on their specific pattern, smooth functions of time and interactions of time with conflict severity, conflict outcomes or outside policies (aid, peace-keeping) will be tested. To choose between the different models for a given estimator, information criteria can be employed. Generally, the Arellano-Bond estimator should serve as the benchmark for testing specifications.

Cost Computations: Using the coefficient estimates from the preferred regression specification allows estimating global GDP losses for current and past conflicts, neglecting future costs of present conflicts. Calculating the predicted GDP per capita for countries given their characteristics with and without conflicts yields a cost-estimate for individual countries, ignoring unobserved growth determinants. Adding up of these costs using population weights for the different countries yields a measure for world-wide costs in a given time period. Computing the difference between the estimates for the most recent year for which data is available and for the previous year can be seen as the added losses of the current year.

6.1.4 Extended Model IIa: Indirect Effects

The first extension of the baseline model introduces indirect effects. In what follows, only the difference between this approach and the baseline model are described.

Augmenting the model requires more data. In general, it can be taken from the World Development Indicators and other sources.

Introducing indirect effects requires the simultaneous estimation of a several equations. While the econometric theory is, in principle, comparable to that above, its implementation can become more cumbersome when the final specification of the baseline model implies that the lagged endogenous variable has to be maintained as a regressor. In that case, the implementation of the Arellano-Bond estimator augmented by an additional system of equations, albeit excluding more dynamic effects, could become necessary. In contrast, for the within-group panel estimator, the implementation involves just standard software.

Concerning the question which channels should be included, we propose a theory-guided approach. The existing literature suggests that sizeable indirect effects via both investment in physical capital and military expenditure can be expected. Equations for these two variables should therefore always be included. These could be augmented by equations modelling the sectoral characteristics such as primary exports or equations relating to foreign direct investment, the trade balance, or institutions and policies. Only those channels, which have a significant influence on the growth equation, should be retained. Otherwise, this extension would follow the outline for the baseline case.

6.1.5 Extended Model IIb: Simple Welfare Analysis

An alternative extension of the baseline model would be to compute welfare effects of the baseline model similar to the model used by Hess (2003). To that end, the dependent variable could be replaced by real consumption per capita growth, which can also be obtained from the Penn World Tables.

While all the estimation would proceed along the lines of the baseline model, apart from a growth equation also the variance of growth would be modelled and data for annual frequency would be used. Maintaining dynamic effects of conflicts, controlling for possibly endogenous conflict characteristics and using additional control variables would provide some improvement of Hess' methodology. Further improvements are due to weighting for different population sizes and possibly a sensitivity analysis for different parameter values in the utility function.

6.1.6 Extended Model III: General Equilibrium Welfare Analysis

Incorporating both extensions of the baseline model described previously, the most complex computation of costs of conflict would be based on a general equilibrium model.

To that end, a model including several channels as proposed in extension IIa, would be used to establish typical reactions of economies to armed conflicts. The inclusion of channels such as foreign direct investment or the trade balance would provide some guidance on international spillovers, although these are implicitly assumed away in the estimation in IIa which is justified in the case of small economies. A general equilibrium model would also automatically encompass the partial equilibrium model employed in model IIb. However, assuming that effects of the variance of growth rates and business cycles are only of second

order, it seems reasonable to restrict the analysis to growth effects only and to use standard linear approximations of the applied general equilibrium model to solve the model economy.

For such a general equilibrium model it would be valuable to have additional micro-level studies to estimate deep parameters, i.e. those relating to time preferences and risk aversion. While such estimates exist, it seems potentially important to analyze whether in countries which are typically affected by conflicts the values used in the standard literature also apply. Additionally, micro-level studies can provide additional benchmarks for calibrating the model, e.g. by analyzing coping strategies that involve sectoral changes or international migration. Having such benchmarks would greatly enhance the reliability of any estimates.

The precise specification of the model has yet to be developed, but it seems promising to build on existing multi-country multi-sector trade models and to incorporate stochastic productivity shocks in different sectors as well as possible relative demand shocks. Also some function involving costs of conflict-prevention or peace-keeping should be ideally included. The setting-up of a benchmark model would then follow an iterative procedure of calibration and comparison with the identified benchmark effects. Once satisfactory parameter values are found, the cost computation would then follow the standard procedure in applied general equilibrium models: It would be computed by how much household income in each country would have to be changed in order to obtain the status quo utility in a peaceful world. Aggregating these changes using population weights would then yield the (presumably positive) welfare gain of peace.

6.1.7 Optional Components

Either of the above proposals can be improved by extending the estimation model underlying the cost computations by the three following optional components. We consider those as optional as they are simply resource-intensive. They are not crucial for either model, but can improve precision of the estimates.

First, **data imputation** can be used. This addresses sample-selection issues, although assuming that selection on endogenous variables is not an important issue. This assumption could be tested in the baseline model using the Heckman approach outlined above. In line with the current applied and theoretical literature it seems, however, justified to resort simply to imputation methods. One of these is outlined in King et al. (2001) and could be applied in the present context as described in Hoover and Perez (2004).

Second, **additional conflict characteristics** can be added. Imai and Weinstein (2000) consider also the geographical spread of conflicts using the data provided by the State Failure Project. Their underlying motivation is to test for the intensity of a conflict relative to the size of a country. Since we included this idea in the baseline approach by relating battle deaths to the population of a country, this effect is already included in the baseline model. The extension would, however, make it possible to test which measure performs superiorly, albeit at the cost of additional resources.

The third option is similar in spirit: In addition to the UCDP/PRIO dataset also **alternative datasets** about conflict characteristics are used. This provides additional robustness checks of the implications of either of the models proposed above and can be easily integrated in either approach at the cost of additional resources.

6.2 Addressing Other Forms of Mass Violence

This background paper offered a comprehensive review of the literature on the economic costs of mass violent conflicts. However, as mentioned before, we had to focus on key topics to capture the complexity of the overall task. This focus has a content, a methodological, and a data reason: armed violent conflicts more than any other form of conflict affect the poorest of the poor in this world (cp. section one); The direct link between armed violent conflicts and reduced development can be shown with more scientific rigor than any other link between violent conflicts and development; finally, for no other form of conflict can we rely on widely recognized data sets. Nonetheless, our proposal is highly adaptable to other forms of violent conflicts. Therefore we offer some ideas on additional topics which are interlinked to our research.

6.2.1 Low Intensity Conflicts

Low intensity conflicts encompass, above all, gang violence and labor struggles.

Gang violence like armed violent conflict burdens a society by the destruction of assets and the injure and murder of people. Additionally, it decreases comprehensive security and thus threatens further economic prosperity. However, to integrate these costs on a global level, further work on data has to be done. Furthermore, there are strong hypotheses that it is still much more difficult to distinguish between cause and effect of gang violence.

The same applies to **labor struggle**. There is no doubt that strikes have immediate economic costs. However, here too, cause and effect are difficult to distinguish. Regarding the amount of strikes in different sectors in different countries, we face serious data problems regarding a global calculation of effects.

Nonetheless, overcoming these problems, we can integrate these conflicts in our proposal. Here, a strong input from micro-level studies could be helpful for cross-country studies.

6.2.2 States and Violence

A second form of violence with consequences for economic development is the link between states and violence.

Still in debate are the consequences of **authoritarian violence** on the economy, as modernization theory regarded authoritarian governments at least not a burden if not an asset for economic development. Regarding our findings that lost investment is one of the central problems of armed violent conflicts, authoritarian governments should not per se have an impact on the economic development through this channel. However, regarding other channels like the state of law, homicide and suppression, we can hypothesize economic costs of this form of violence. Here, too, our proposal can be applied, but special attention has to be dedicated to the modeling of channels and on data problems.

Another prominent notion regarding mass violent conflicts is that of **'failing states'**. This notion regards a disintegrated society, which generally goes along with the break down of the state of law, consequently higher insecurity and, in the light of our literature review, probably reduced development. However, the debate is still in its infancy and even its notion is argued (Bilgin/Morton 2002). First attempts to measure their costs should be considered preliminary, as they focus above all on policies and not on violence (Chauvet/Collier/Hoeffler 2007). The main scientific protagonists are found in the political science theory and here cross-country studies are still the exception. Further micro-level insights should help to adapt our proposal to capture the economic costs of failing states (Binzel/Brück 2008).

A sidestep to this debate is the debate on **warlord systems**. Against a first absolute condemnation of these forms of governance, science tried to differentiate the characteristics of such institutional settings (Reno 1999). Apart from data problems, as war lord systems just extend to a regional level, there are methodological problems to differentiate causes and effects of violence. However, from a general point of view, an adaptation of our proposal

should be possible, hypothesizing higher transaction costs and lower investments because of discriminate security structures and eventually resulting insecurity.

6.2.3 Structural Violence

This is quite difficult for structural violence (cp. Galtung 1969), as this kind of violence differs significantly from our definition. Structural violence does neither lead directly to a breakdown of the social contract nor is the use of physical violence a key aspect. Therefore, the main characteristics of mass violent conflicts, like destruction and reduced investment, do not apply directly to the concept of structural violence. Therefore, our proposal cannot simply be adapted to capture this empiric phenomenon.

6.2.4 Global Organized Crime

Meanwhile, global organized crime is strongly related to our key field of research (Kaldor 2007). It undermines the state of law, leads to insecurity, and spreads the consequences of violent conflicts over the entire globe. Furthermore, it decreases state revenues. However, facing data problems with the 'legal' developments, capturing the illegal part can just be estimated on a very weak base. Here, too, strong micro-macro cooperation is the only solution to get trend projections on a global level. If adapted in this way, our general proposal should be helpful.

6.2.5 Accounting for Other Types of Violence: Additional Insights

In a document published by the WHO and the Center for Disease Control and Prevention of United States (CDC), Butchart et al (2008) carefully explains a method to calculate the economic costs of interpersonal violence, that is violence inflicted by another individual or a small group of individuals and self-directed violence. The advantage of this approach is that it defines a method that can be applied to different countries or regions, which would allow for consistency in the comparison of the costs of violence, assuming the data on which it is build is also consistent across countries and regions.

Their methods assumes the availability of incidence data on injuries (both fatal and non fatal), medical cost data and estimates of lost productivity. Each of these sources is informed by survey or epidemiological data and therefore the ability to replicate the study for many countries and over time becomes a complex task, which can only be taken by coordinating different research centers around the globe in order to obtain comparable estimates. This is a

disadvantage of the proposal, in the sense that coordination and material efforts might be prohibitive or only affordable by large global institutions, like the World Health Organization.

Nevertheless, their bottom up approach is important in stressing the role of micro-level data in understanding incidence and costs of violence. In such an approach, certain parameters of the model (the cost-per event) module could be kept constant (to minimize costs of repeating surveys), while incidence data could be updated more often, perhaps including questions on household surveys (in case injury statistics are not readily available from official sources). Such an approach could also be used for community violence, in case data requirements are met.

A macro-approach on the costs of violence, akin to the models to estimate the impact of violent mass-conflicts described before in this report, was taken by Londoño and Guerrero (1999). In their case, they focused on the effect of socioeconomic indicators (income, poverty, inequality and education) as determinants of homicide, thus emphasizing one direction in the relationship socioeconomic indicators-homicide.

Their estimation is based on panel data and shows an 'U-shaped' relation between income and education on the one hand and violence (captured by homicide) on the other. It is only after income and education exceed a certain threshold that violence drops. However, it is not clear why such a non-monotonic relation between violence and social indicators is observed in the data. If poorer countries are more likely to suffer from severe underreporting of violence (a hypothesis that is difficult to be tested), then the estimates of such relationship may not be meaningful, since the "true" dimension of violence is not measured accurately, or moreover, measured with bias.

Nevertheless, the results provided by Londoño et al. (1999) highlight the perils of studies using cross-sectional data, in which the estimates obtained are of different sign. In addition to these, the authors complement these findings with different sources of statistics -where are available- and estimate a cost of violence ascending to 14% of GDP, but with wide variability depending on the country under consideration.

One of the messages that emerges from the literature mentioned before is the need for consistency between different assessments and the need for disaggregate data. A recent report from the UNDP office in Guatemala (PNUD 2007) has satisfactorily addressed these two steps. First, with a common methodology it has compared the economic cost of violence in Guatemala and El Salvador. Overall, they find costs that are approximately between 7 and

11% of each country's GDP, but it differs depending on different dimensions of costs, which we will refer to below. Second, they use victimization surveys which allow controlling for non-reporting. Results from these surveys indicate that 3 in 4 crimes are not reported, therefore highlighting the perils of using official reports as indicators of victimization.

The PNUD (2007) report on violence in Guatemala considers 5 different dimensions of costs of violence to be measured.

1. Health costs and years lost due to violence, which amounts to about 3% GDP in Guatemala. The bulk of this figure comes from lost productivity (due to death and disability) and emotional costs.
2. Institutional costs for the provision of security and justice, amounting between 1 and 2% of GDP, mostly due to the burden on the judiciary system.
3. Costs in security paid for by the private sector, amounting between 2% and 3% of GDP.
4. Costs in terms of reduced tourism and lower investment (between 0.2 and 1% of GDP).
5. Material losses, mostly due to theft (cars, private houses), accounting from up top 2% GDP depending on the country.

The estimate for El Salvador (11.5%) is in line with other estimate from Buvinic, Morrison and Shifter (1999), which stipulates a cost amounting to 24.9% of GDP for the same country, but also accounts for cases of collective violence (see Buvinic, et al, 1999).

Such an approach may be difficult to replicate in other countries because data sources may vary or because of the problem of double accounting mentioned elsewhere in this document. In addition to this, these studies do not incorporate the concept of counterfactual, and compute all costs related to violence, when some of them may also be related to other indicators of development.

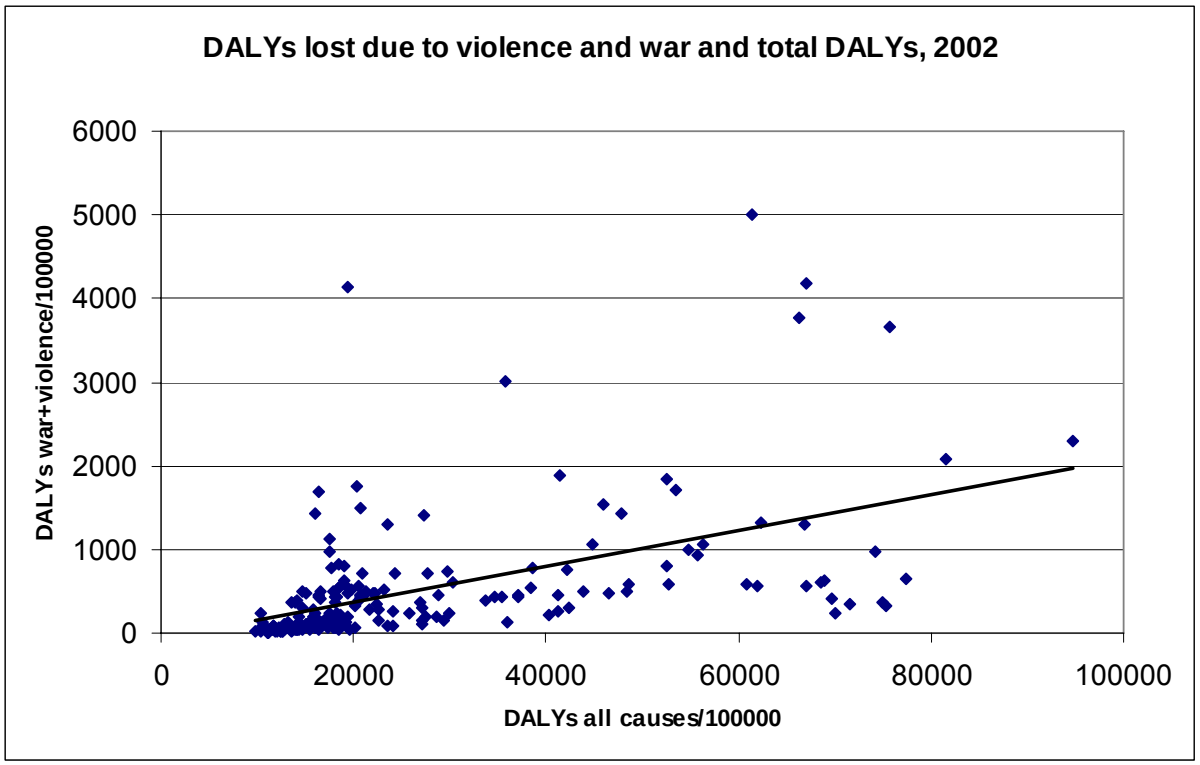
In reviewing country studies (few of them on low-income countries to be representative) we have neglected other sources of aggregate data which may have some consistency. It is possible to use such data as an additional input in cross-country studies. For example, the World Health Organization has reviewed different sources of data on mortality and morbidity around the globe and condensed it in the reports of Global Burden of Disease (see for example Mathers et al. 2003). While these indicators may not completely capture the economic costs of violence, some of their components may overlap, for example deaths and disabilities as contributors of lost productivity.

A simple indicator that summarizes the health gap is the disability adjusted life years indicator (DALY). Following definitions of WHO, DALYs for a disease are the sum of the years of life lost due to premature mortality (YLL) in the population and the years lost due to disability (YLD) for incident cases of the health condition. The DALY is a health gap measure that extends the concept of potential years of life lost due to premature death (PYLL) to include equivalent years of 'healthy' life lost in states of less than full health, broadly termed disability. One DALY represents the loss of one year of equivalent full health.

The World Health Organization currently provides information by country on DALYs and disaggregates them by cause, including violence and war. Since DALYs may be high in low income countries not entirely because of violence, we first analyze WHO country data (for year 2002) by calculating the proportion of DALYs due to violence and war. This proportion ranges from almost 0 to 21%. At the top of the list is Colombia, followed by Venezuela, the Former Yugoslav Republic of Macedonia, El Salvador, Sudan, Burundi, Brazil, Algeria, Somalia and the Democratic Republic of Congo. In some of these countries, violence (Venezuela, Brazil) explains the absolute majority of DALYs due to violence and war. At the other extreme stands Burundi and Congo, where most of the burden is due to war related deaths and disabilities.

Figure 6–2 shows that the burden of violence and war (in terms of mortality and morbidity) and the total burden of disease are positively related. That is, countries where health indicators are particularly adverse are those more affected by violence and war. There are exceptions, like Colombia, a country where the burden of disease is not high, but where violence leaves its mark in terms of disability and death by as much as in the Democratic Republic of Congo or Burundi.

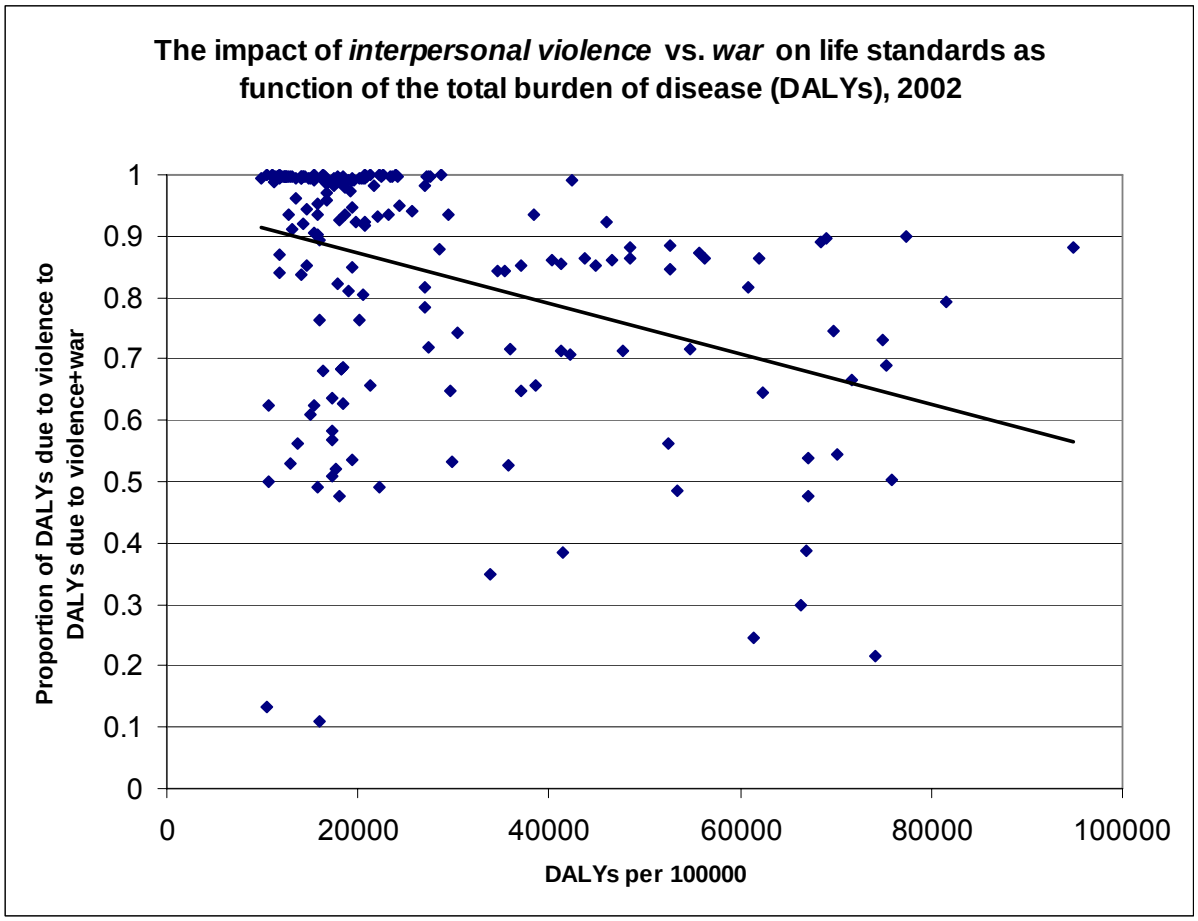
Figure 6-2
DALYs lost due to violence and war and total DALYs, 2002



Source: own calculations based on Burden of Disease Estimates from the WHO.

The proportion of DALYs lost to violence vs. war also changes depending on the country. Figure 6–3 indicates that it is in countries where the burden of disease is higher (mostly countries with low income), most of the deaths and disabilities from war and violence are due to war, although the strength of the relation is not strong, and there are exceptions. For example, Israel and the Former Yugoslav Republic of Macedonia stand as low burden of disease countries the ratio of DALYs due to war to DALYs due to violence is in a magnitude of almost 10:1.

Figure 6-3
The impact of interpersonal violence vs. war on life standards as function of total burden of disease (DALYs), 2002;



Source: own calculations based on Burden of Disease estimates from the WHO.

Data coming from the burden of disease, by measuring mortality and morbidity due to war and violence may constitute in itself a useful correlate of the economic costs of violence/war in absence of other indicators which may only be observable in a restricted number of cases. Nevertheless, one should be cautious about using these results at face value, because the quality of these statistics varies, although this has also been assessed by the WHO.

Using the methodology proposed to calculate the costs of violence in Guatemala (Balsells Conde, 2006), one could replicate certain components of the cost of violence indicated in that study (losse in productivity due to death and disability) and calculate it using WHO data for different countries. Data from income could be approximated from GDP per capita, although this might be an oversimplification because violence may be targeted to certain groups.

Another approach is to use data for mortality and morbidity due to wars and include it in cross-country regressions to estimate the effect of these events on economic growth. In this sense, one could also account for the magnitude of wars by complementing event data with data from mortality/morbidity due to wars. The problem with this approach is that burden of disease data is available for a limited number of years, and thus some robust techniques of estimation may not be feasible with this type of data.

6.3 Policy Implications

While not in the focus of our report, the evaluation of the literature has two obvious policy implications.

6.3.1 Public Data Collection

Assessing other forms of violence faces one key problem: the availability of data. However, even the more explicit armed conflict datasets are disputable. Actualized data are one problem. At the moment this actualization depends on the (university) financing of single projects. Another problem is the availability of disaggregate data on conflicts. Until now, we just know when conflicts are happening and who is fighting. Additionally UCDP/PRIO does provide data on battle deaths. More ambitious actualized information – on the kind of warfare, on the spread of violence, on the type of war economy – is missing, even though they are central for developing a more in depth understanding of the consequences of contemporary mass violent conflicts. Additionally, the more prominent data sets do not face the focus of modern warfare on civilians. The purposeful killing, humiliation and displacement of non-combatants have a key impact on the costs of conflict.

As shown by this project, armed violence is a central burden to the global society. Therefore two points are not satisfactory: that the data availability is that scarce and that data availability depends on university projects or even single scientists. Thus, what is needed is the development of a network of standardized information gathering regarding armed conflicts and its characteristics as well as the pooling of this information and its public availability. The theoretical framework could be extracted from existing debates on conflict data sets (cp. Chojnacki/Eberwein 2001).

This project can and should include the development of a standardized way to aggregate micro level data for cross-country and cross-section analyses.

6.3.2 Implications for Development Policy

Quantifying the costs of violent conflict is important for drawing attention to this as an impediment for development but, by itself, will not improve the livelihoods of those affected. Clearly, developing a reliable cross-country model of costs of conflict that takes account of the most important channels through which conflict hinders growth gives some guidance about the problems caused by conflicts. Successful cost-models will most likely also allow for differential effects of different types of conflict. Together, the research on channels and effects of conflict characteristics give some guidance for policy: If most effects of a certain type of conflict materialize themselves through certain channels, it seems warranted to concentrate reconstruction policies in these areas.

But the contribution of country-level studies can only be to indicate on which aspects of development micro-studies should focus on because these studies cannot be directly converted into differentiated advice for development policies. Existing research points at the importance of some macroeconomic indicators for development generally and also post-conflict development. Investment is an important channel through which conflicts affect growth negatively since conflict causes investment to decline. So making up for this lost investment in (human or physical) capital should contribute to compensating for negative growth effects. But investment is an aggregate which covers inventories as well as housing and machinery. Given scarce resources for reconstruction, which type of capital should be given priority? Even more specifically, where should these investments be channeled to and which instruments (e.g. tax rebates, complementary public investment, facilitation of credit) might help to do so? A similar problem occurs with the findings by Collier and Hoeffler (2004). They present tentative evidence given social policies a priority after conflicts. This provides already some disaggregation of their overall policy indicator, but as discussed in section 3.3.3, this provides little guidance to what element of social policies are included – improved pension systems, child nutrition programs or other measures?

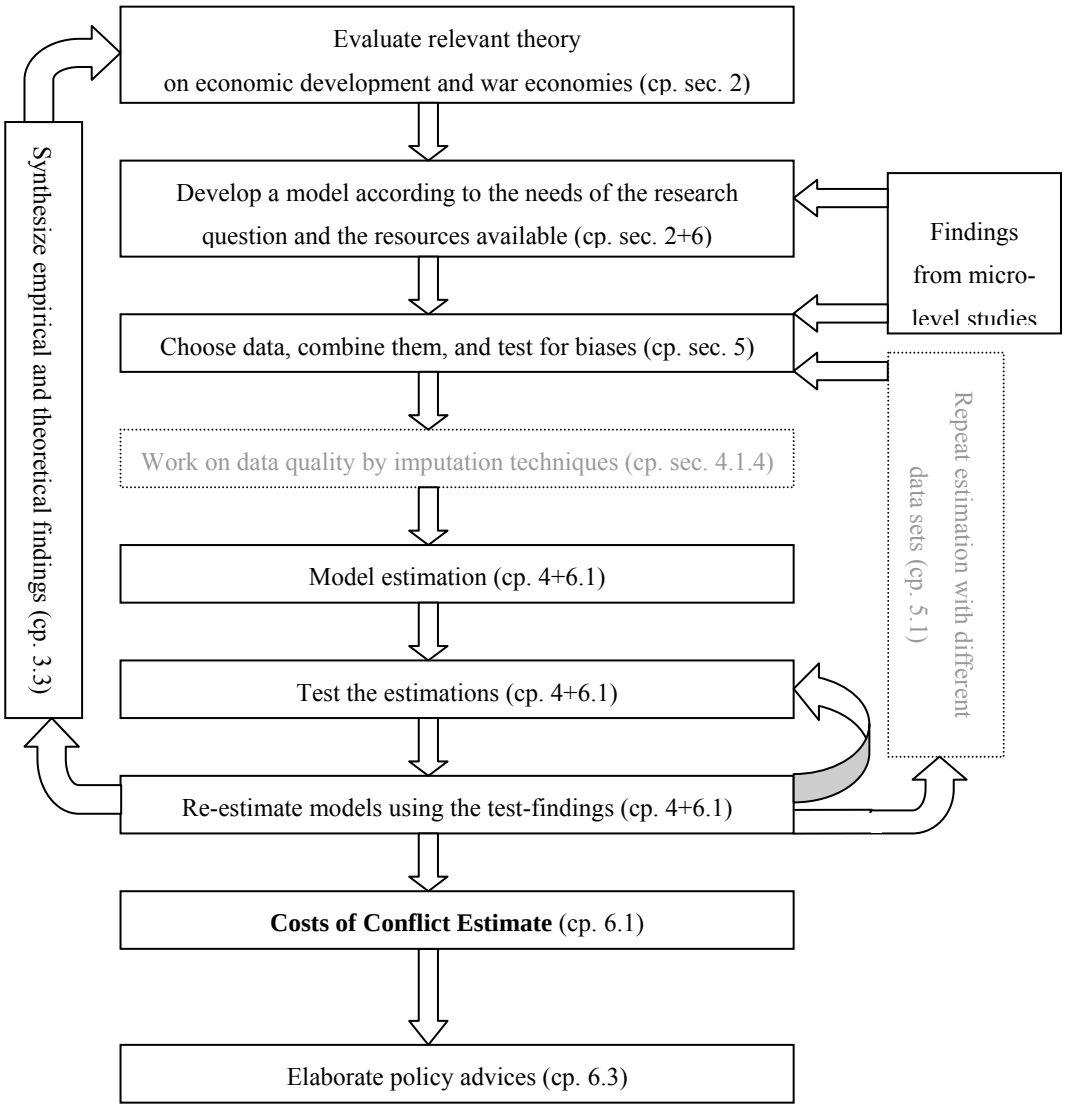
These examples indicate the need to look behind general indicators. Such a closer examination must, naturally, include an analysis of which groups of the population are disproportionately affected, as preliminary analysis indicates differences, e.g. regarding rural/urban areas, war zones/hinterland, etc. If research should contribute to improving livelihoods and overall development, more effort has to be dedicated to systematic studies

with disaggregated data. By analyzing the problems and successful coping strategies of households and businesses more tractable policy advice can be developed.

6.4 Workflow

The following figure provides a simple representation of the necessary work flow for elaborating the cost estimates and the subsequent policy advice.

Figure 6-4
A preliminary workflow chart



7 Conclusion

This paper showed that although the calculation of economic costs is an essential task regarding mass violent conflicts, the debate is still in its infancy. There exist about twenty-five key studies, about half of them in cross-country style, half of them focusing on certain conflicts and/or countries. Comparing these two approaches, we can draw the following conclusions.

Table 7-1
Cross vs. Single Country Studies

Topic	Cross-Country Studies	Single-Country Studies
calculation of global costs	+	-
accounting for externalities	+	-
generalized insights	+	-
data-intensity manageable	+	-
control systemic changes	+	+/-
control on pre-conflict path dependences	+	+/-
control on double-counting	+	+/-
analysis of mechanisms	+/-	+
disaggregate data	+/-	+
type of conflict	+/-	+
specific country conditions	-	+
usage of differentiated data	-	+

For our task of calculating global economic costs, just a cross-country study is feasible. Thereby, we can account for externalities (costs of migration, border security, re-allocated aid etc.), which no single-country study in the surveyed literature considers. And insights from cross-country studies can be used as a first sketch to estimate costs of a mass violent conflict in a single country, when better surveys are not available. From a methodological point of view cross-country-studies can include changes in the global environment already from the beginning. Single-country studies have to be very careful not to overlook regional or global changes with local consequences. This holds true for country-specific pre-conflict path dependences, too. While cross-country studies can account for them by comparing the developments with the development of other countries, this is a hard challenge for single-

country studies. Finally, as cross-country studies normally do not use accounting methods, the danger of double-counting is small.

On the other hand, single countries have specific advantages that we have to be aware of and try to integrate in our model. While the analysis of mechanisms is theoretically possible by cross-country studies, they often fail because of data problems. Here single-country studies can offer insights and hints, which can be used afterwards as hypotheses to be tested and integrated in a cross-country analysis. The same applies for disaggregate data. Here, too, single-country studies can rely on a wider range of data. As mentioned in chapter six, we can use insights from single-country-studies and micro analysis, either to differentiate our theoretical model and hypotheses and/or to fine-tune a more sophisticated CGE-model like we proposed as extension III. Also for policy advice, micro-level studies can be especially useful.

So why is it impossible to use simply one of the existing cross-country analyses? We divided the problems in the current debate in three groups: content, methodology and data.

The existing literature does cumulate some ideas, uses some indicators, and gets out some numbers. However, the studies miss a more profound link between theory and empirics. Thus what follows are two tasks: On the theoretical side, we have to differentiate our understanding of the link between mass violent conflicts and the economic consequences, including channels through which we can trace indirect effects. On the more empirical side, we have to work on the understanding of channels including the development of hypotheses, on the operationalization of our definitions, and on a more careful test of validity of our proxies. Only in this way can we get a comprehensive understanding of the interplay of seemingly important channels like investment, public/military expenditure, and different forms of capital (financial, human, social, land, etc.)

This leads us to the methodological findings: the most popular method is the usage of standard econometric models. Most of the studies offer insights, but above all, the robustness is doubtful. Additional effort has to be invested in the application of more sophisticated analyses (like imputation methods or dynamic panel data estimators) and a more comprehensive system of tests.

Regarding data, there are two prominent data sets on violent conflicts: the older one from Correlates of War, and the newer one from UCDP/PRIO. We do favor the UCDP/PRIO as it is updated to the present. Having enough resources, models should be tested on both data sets, as they differ along their coding. For economic data, we can rely on the prominent Penn

World Tables, and additionally on data from the World Development Indicators from the World Bank. Additional information, for example from UN-organizations like the WHO and UNDP, offer more disaggregated data; however, these are pure cross-sectional datasets, which are of limited value for panel analysis.

Another possibility is a computable general equilibrium model. Here, too, our content and theory claims apply. However, we have a qualitative break compared to the regression models. The importance of a sophisticated theoretical analysis increases. But on the other hand, our possibilities on the methodological as well as on the data side increase. On the methodological side, we can differentiate channels more precisely. And on the data side, the big advantage is the possible inclusion of findings from single-country macro studies as well as from micro-level studies. This leads us back to the content question as we can integrate now topics like social capital, which is not really feasible for simple regression analysis.

Our proposals fit with these analyses: our base line model includes a more sophisticated regression analysis than in the current literature. As extension we propose a differentiated analysis of channels or a switch to calculate welfare losses other than growth. As the most ambitious model we propose a CGE-model, which differentiates along a horizontal dimension (impacts; channels) as well as on a vertical dimension (including data from single-country and micro-level studies).

To increase the quality of our estimates, we can add effort-intensive fine-tuning: we can work on our data by data imputation techniques, augment included conflict characteristics (which again needs work on our data), and thirdly calculate our model on different data sets (e.g. COW + UCDP/PRIO).

Getting these findings, we should understand how mass violent conflicts are leading to devastating economic costs. This is the base for policy advice, although the models proposed here are not enough for reliable policy advice. Without a differentiated and high quality analysis which must necessarily include micro-level studies, policy advice can do more harm than good. However, time is pressing and the daily death and starving of people warrants an immediate effort to work on causes, dynamics, and consequences of mass violent conflicts. We just offer one model to work on a piece of the wider puzzle; however, we consider it as a key one which can form the basis for future work and, thereby, hope to contribute to a peaceful evolution of our world.

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