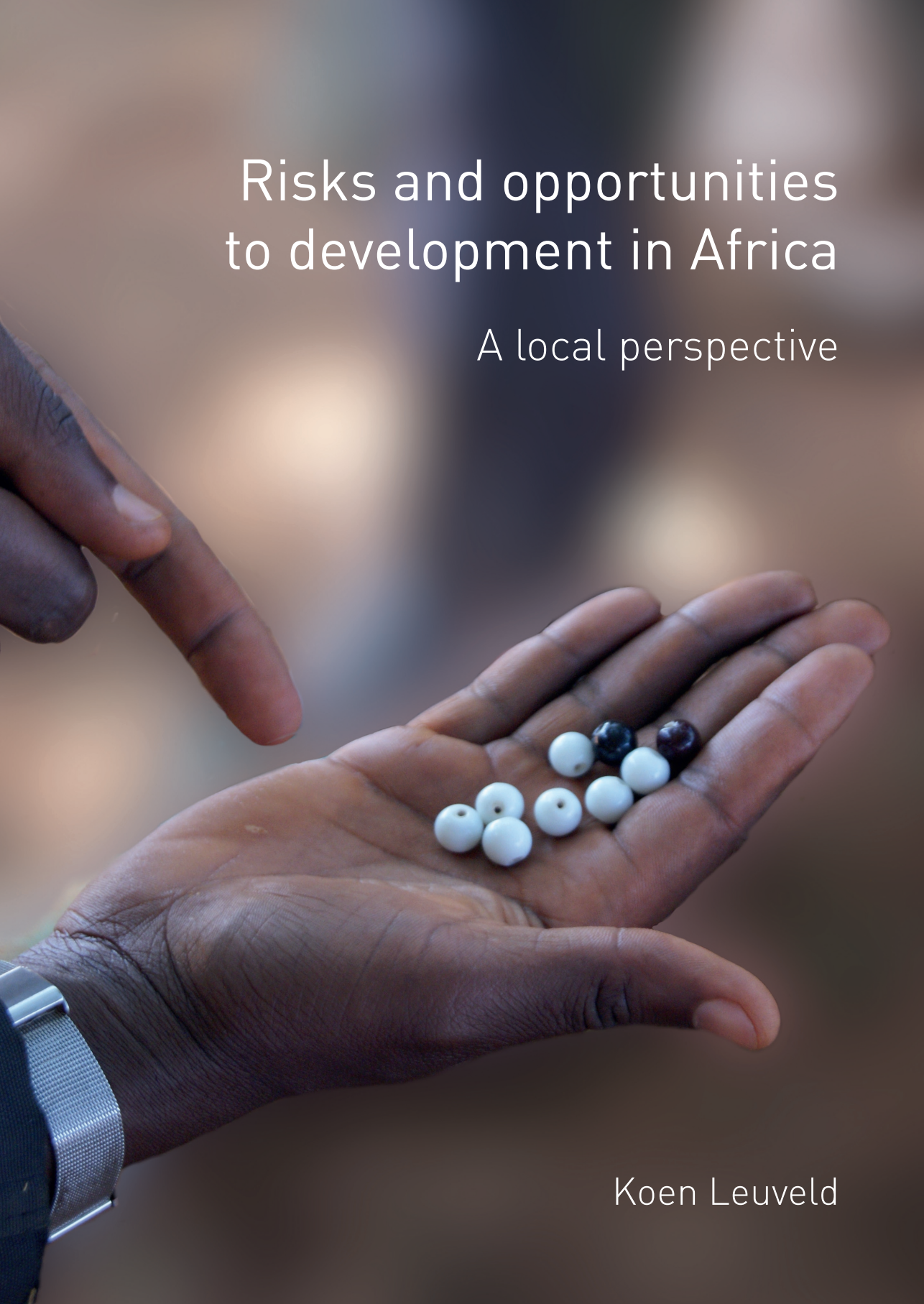
Risks and opportunities to development in Africa

A local perspective



Koen Leuveld

Risks and opportunities to development in Africa

A local perspective

Koen Leuveld

Thesis committee

Promotor
Prof. Dr E.H. Bulte
Professor of Development Economics Group
Wageningen University & Research

Co-promotor
Dr M.J. Voors
Associate professor,Development Economics Group
Wageningen University & Research

Other members
Prof. Dr E. Frankema, Wageningen University & Research
Prof. Dr D.J.M. Hilhorst, Erasmus University Rotterdam
Prof. Dr J. Peters, RWI – Leibniz Institute for Economic Research, Germany
Dr P.C. Van Der Windt, New York University - Abu Dhabi, UAE

This research was conducted under the auspices of the Graduate School of Social Sciences

Risks and opportunities to development in Africa

A local perspective

Koen Leuveld

Thesis
submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus,
Prof. Dr A.P.J. Mol,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Wednesday 30 November 2022
at 1.30 p.m. in the Omnia Auditorium

Koen Leuveld
Risks and opportunities to development in Africa: A local perspective
126 pages.

PhD thesis, Wageningen University, Wageningen, the Netherlands (2022)
With references, with summary in English

ISBN 978-94-6447-480-0
DOI https://doi.org/10.18174/580319

Some graphs and tables I made for Aster.

Contents

Chapter 1

Introduction

1.1 Problem Statement and Research Area

Over the past decades, the world has made tremendous progress in fighting poverty, but this progress has not happened everywhere in equal measure. Between 1990 and 2017, the share of people wordwide living under the absolute poverty line of $1.90 a day fell from 36.2% to 9.3%, while the share of Africans below the poverty line decreased less dramatically: from 58.4% to 40.4% (World Bank, 2022). Furthermore, because of population increase on the continent, the absolute number of Africans living in poverty has actually increased over this time, as has the proportion of the world's poor who live in Africa. Even within Africa, poverty rates have not declined uniformly across countries, with some countries faring worse than others. This means that the global poor are increasingly concentrated in a limited number of countries. The World Bank expects that by 2030, up to two thirds of the world's extremely poor live in Fragile Conflict-affected settings, and mostly in rural areas (World Bank, 2019).

This concentratation of the world's poor in settings that defy the global trend of sharply decreasing povery rates has implications for the way in which we think about development. First, it means that the focus should be at a local level to investigate the local dynamics that underlie (or are caused by) the lack of development. It also implies that a healthy dose of intellectual modesty is in order. Achieving development may not be one question with one answer, but rather a puzzle with many pieces, some more important in some cases than in others. In this thesis I take such a local approach; I present evidence gathered at the micro-level in three countries: Sierra Leone, Cameroon and the Democratic Republic of the Congo (DRC). Each of these areas face their different issues, so the focus of the work done in each of the countries is different.

Sierra Leone is an often-used example of a conflict-affected country. In 2010, the year when the Sierra Leonean data for this thesis was collected, the largest development challenge was recovering from the

civil war that lasted from 1991 until 2002. During the course of the conflict, it is estimated that over 50,000 people lost their lives, and even more were victimized by widespread human rights violations, from mass rape to mutiliations, perpetrated by all sides of the conflict (Human Rights Watch, 1999). Youth played an important role in the conflict, both in the grievances that caused the conflict (see e.g. Peters and Richards, 1998; Richards, 2005; Peters, 2011), as well as in the actual fighting during the conflict (Humphreys et al., 2013). After the war, youths in the country were still left with little chance due the economic fall out of the conflict. Agriculture, the largest sector in the country was hard-hit, leading to a high depedence on imported foodstuffs (FAO, 2005).

Chapter 2 draws on a study done with youths who participated in a football tournament in Kenema, Eastern Sierra Leone. The study focuses on the impact that their experiences during the conflict have had on their behaviour, and discusses potential implications of this for their future economic success.

Like Sierra Leone, the DRC has experienced violent conflict in its recent history. While the Second Congo was ended by a peace agreement in 2003, there are still armed groups active in the country, particularly in the east. After years of conflict, daily life for many in the DRC is miserable. The country lags behind in terms of human development, ranking 175 on the Human Development Index (UNDP, 2020). The enduring conflicts have also depressed agricultural production, by limiting rural households' access to financial assets, land and markets (Lecoutere et al., 2005; Vlassenroot and Raeymaekers, 2008). In 2020, it was estimated that over 20 million people were facing acute food insecurity in the country (FAO, 2020). Life for women in the DRC is particularly bad, facing high rates of sexual and gender-based violonce (SGBV), particularly from intimate partners; Peterman et al. (2011) estimate that 22.8% of Congolese women have been victim of Intimate Partner Violence (IPV), and speculate that that may be an underestimate.

Chapters 3 and 5 draw on work done in South Kivu, one of the poorest provinces of the DRC (Ansoms and Marivoet, 2009). Chapter 3 evaluates the outcomes of a project aimed at increasing agricultural production through the provision of subsidized agricultural inputs. Chapter 5 focuses on the drivers of SGBV. The chapter explores the characteristics of women who have been recently victimized by SGBV.

Chapter 4 is set in the Adamawa region in Northern Cameroon. The Adamawa region is mostly rural, with low population densities. The predominant source of income is agriculture. The most important challenge to development for the region is its remoteness. Most households in our study sample live in small villages, which means that they lack access to markets and the opportunities to development they entail. The chapter is based on the results of an Investment Game, a behavioural game commonly used to measure expectations about other people's behaviour, an important component of trust and thus of social capital. The paper focuses on the differences in determinants of behaviour in the game between respondents in village with markets access and those in villages without.

1.2 Research Question

While clearly these three research areas face different challenges, there is a common thread in their experiences with development. Each area faces certain risks and opportunities – such as conflict, and development aid – which impact important development outcomes – such as agricultural productivity and human rights. The core argument in this thesis is that the effect of each of these risks and opportunities on development outcomes is not direct. The effect is mediated through factors at the local or even the individual level, which in Figure 1.1 I capture under the term Social Capital and Institutions (for a more thorough review see below). The chapters of this thesis each discuss a different aspect of the interplay between risks, opportunities, social capital and development outcomes. The questions they answer are as follows.

1. What is the relationship between violent conflict and competitive behaviour? (Chapter 2);
2. What is the effect of input subsidies on novel technology adoption? (Chapter 3 4);
3. What is the effect of market access on behaviour in the investment game (Chapter 3 4); and,
4. What are the drivers of sexual and gender-based violence in Eastern Congo (Chapter 5).

1.3 Theoretical framework

Figure 1.1 outlines the relationships between the main topics of this thesis. On the right-hand side, there are two indicators for development that are present in the areas of interest in this thesis: human rights and (agricultural) productivity. On the left, there are three risks and opportunities: violent conflict, markets, and development aid. These risks and opportunities do not translate directly in development outcomes; rather, they are mediated through social capital and institutions.

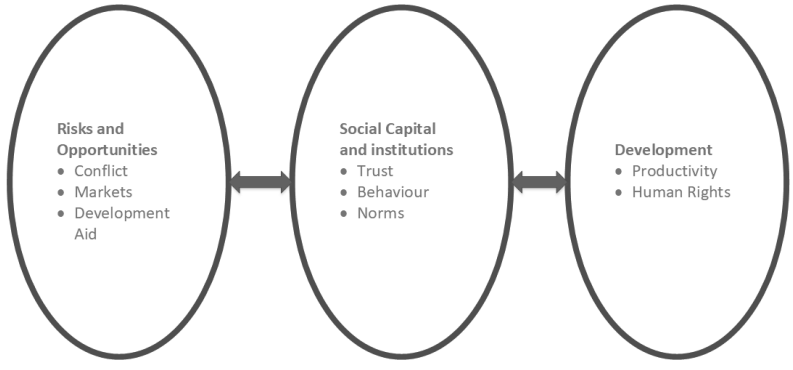


Figure 1.1: Conceptual Framework

1.3.1 Risks and Opportunities

The first risk to development I consider is violent conflict. Collier et al. (2003) expresses the risk posed by conflict to development by labelling it "Development in Reverse". The World Bank further underscored the importance of violent conflict in shaping development outcomes by titling their 2011 World Development Report "Conflict, Security, and Development" (World Bank, 2011). Aside from the human rights violations that are inherent to violent conflict, other consequences include: decreased economic activity (Collier, 1999) deforestation (e.g. Burgess et al., 2015), long-term incidence of domestic violence (e.g. La Mattina, 2017; Müller and Tranchant, 2019), (mental) health problems (e.g. Smith et al., 2002; Iqbal, 2006; Akresh et al., 2011) and food insecurity (e.g. Lecoutere et al., 2005; Verwimp, 2012). However, some effects which may have some benefit to long-term development have been described, such as increased collective action (Bellows and Miguel, 2009), political participation (Blattman, 2009) and increased pro-social behaviour (Voors et al., 2012).

Among the countries where data collection was done for this thesis, two have a recent history of conflict: Sierra Leone and DRC. The conflicts have had far-reaching effects. In Chapter 2, we examine some of the impacts that conflict has had on the behaviour of youths in Sierra Leone, in particular with respect to their willingness to engage in competitive behaviour. Such competitiveness is crucial in shaping economic outcomes and productivity, and a such plays an important role in development (Niederle and Vesterlund, 2007). Childhood and adolescence are a crucial time in the development of such preferences (Benenson et al., 2007; Fehr et al., 2008; Sutter, 2007), and intense shocks such as conflict that happen during this time may thus have a large impact. We test this using a set of behavioural games in a population of Sierra Leonean youth.

The conflict that has persisted in the DRC for the past decades is often seen as the root cause for the high rates of SGBV that are the focus of Chapter 5 (Baaz Eriksson and Stern, 2013; Kirby, 2015; Johnson et al., 2010). However, Peterman et al. (2011) find that most SGBV is perpetrated by intimate partners, which casts doubts on the role of conflict as the main driver of the problem. In Chapter 5 I draw on detailed survey data to find the background characteristics of victims of SGBV, allowing me to draw conclusions about the potential drivers of SGBV in Eastern DRC.

Secondly, I consider an opportunity for development: markets. Markets provide opportunities for exchange and specialization, which are prerequisites for economic development. At the national level, trade is seen as a promising way to increase productivity in developing economies. Dutch development aid, for example, has a large focus on the complementarities between trade and development as a way of increasing investments and thus productivity (see e.g. Zoomers and Van Westen, 2014). Aside from these impacts on the national level, increased access to markets have been shown to have effects at the

local and individual level as well: markets are associated with trust (Tu and Bulte, 2010; Fischer, 2008); increased rationality (List and Millimet, 2008; Cecchi and Bulte, 2013; Braga et al., 2009) and decreases in risk aversion (Melesse and Cecchi, 2015). This corresponds with findings that from large-scale societies (which include markets) engage more in pro-social behaviour Henrich et al. (2005, 2010). These national and individual effects make that markets are an important consideration in analysing the development process.

In Chapter 4 I explore the differences markets creatre in how respondents play the Investment Game. This behavioural experiment involves two respondents; the first receives an endowment, which they can share with the second; anything shared is tripled by the experimenter, after which the second player can choose to return part of what they receive back to the first mover. Behaviour of the first mover is largely shaped by expectations of what the second mover will do and pro-social preferences (Berg et al., 1995; Ashraf et al., 2006; Roth and Erev, 1995; Sapienza et al., 2013). Given the effects of markets on pro-social behaviour and rationality discussed above, markets may have an impact on the behaviour of the first mover. We test this by implementing an investment game as part of large-scale survey in Northern Cameroon, where one subset of the surveyed villages has good market access, while another does not.

Thirdly, I consider development aid. At the turn of the century, the Millennium Development Goals were adopted in the hopes that the world's poorest countries (particularly in Africa) could be lifted out of poverty with a large-scale international effort. The underlying assumption was that a core challenge to African economies were adverse geographical conditions which hinder growth; ambitious investments by the international development community could then help increase agricultural productivity and decrease the impact of tropical diseases (Sachs, 2005). This push came out of disappointment with the levels of growth in the 1990s. The mantra of "stabilize, privatize and liberalize", as preached by the IMF and the World Bank, proved insufficient to achieve preferred development outcomes, leading to calls for an increase in the levels of development aid (Rodrik, 2006). However, increased calls for more direct intervention were not the only response to this disappointment: concurrently there was doubt about development aid's capability to achieve meaningful growth. Easterly (2007, p. 329) claimed that Development Assistance was a "mistake", and that "we don't know what actions achieve development". A large literature has since sprung up that aims to fill exactly that knowledge gap and find out which development interventions work, and which do not. Improvements in statistical techniques and data collection methods have allowed development economists to get more accurate assessments of the impact of aid programs. Academics and development NGOs have embraced methods such as Randomized Controlled Trials (RCTs) to find out what works and what does not (see e.g. Banerjee and Duflo, 2011).

This thesis follows in this tradition. Chapter 3 is about the impact evaluation of an agricultural intervention, and both Chapters 4 and 5 were funded by being smaller parts of similar impact evalua-

tions. This reflects the increased amount of field research that is being funded through evaluations of development aid, allowing economists to more accurately determine what actions work and which do not.

1.3.2 Social Capital and Institutions

The impact that these risks and opportunities can have differs across countries. Some countries have been better able to exploit the advantages markets offer than others; one conflict-affected country rebounds more quickly than another (compare for example the fortunes of Rwanda and the DRC). The key factor that sets apart countries that are successful in avoiding risk and capitalizing on opportunities is their institutional environment (Rodrik et al., 2004; Acemoglu et al., 2001). This term is used to describe the rules and norms that shape (economic) life. It covers crucial things such as protection of property rights and equal treatment by the law (Acemoglu et al., 2005). Such good institutions foster development by incentivizing innovation.

It is important to note that such institutions do not only include the formal rules and organizations which organize our lives; it includes informal arrangements shaped by the relations and networks between people as well. Insofar as these relations and networks provide value, they are termed social capital (see for a more detailed discussion of the definition of the term Putnam, 2001). Especially in poorer countries, social capital plays an important role in facilitating economic activity, by providing a substitute for formal institutions (Knack and Keefer, 1997). For example, kinship networks may provide insurance (di Falco and Bulte, 2011), while informal mechanisms may be more efficient at securing property rights than formal ones (Platteau, 1996).

This insight, that social behaviours substitute for formal institutions in facilitating development, suggests that is not just international and national factors that drive development. Rather, relationships and behaviours at the local level may play an important role in shaping outcomes. This means that micro-level data collection is of importance for studying development. The link between violent conflict and behaviour described above and in Chapter 2 is one example of a way in which behaviour and social capital mediate the effect that outside risks have on development. Likewise, the effect market exposure has on behaviour (Chapter 4) has implications for the formation of social capital, and thus development.

1.3.3 Development

As for development, I focus on agricultural productivity and human rights. In part, this choice is idiosyncratic; driven by what the NGOs who cooperate on the projects underlying this thesis choose to focus on. However, that is not to say these aren't important issues world wide. The focus on agricultural production is driven by the fact that the poorest of the world often depend on subsistence agriculture.

Furthermore, agricultural productivity is seen as a necessary precondition for further, economy-wide, productivity improvements (World Bank, 2007).

A key challenge to African agriculture is the low adoption of inputs, such as fertilizers and improved seed varieties. Subsidized input programs have been increasingly been implemented as a way to improve productivity and increase yields (see e.g. Morris et al., 2007; World Bank, 2000). In Chapter 3 we evaluate the impact of one such subsidy scheme in Eastern DRC. This complements the existing literature, which has thus far mostly considered subsidy programs in stable settings where input use is common, by examing the effect in a fragile context where the institutional environment may not be conducive to effecting impact.

However, few NGOs solely focus on productivity, as such a focus is too narrow to fully capture the problems associated with poverty.Productivity gains mean little in the face of widespread human rights violations. Human dignity is a crucial part of development. In addition to agricultural productivity, I focus on human rights as well. In particular, in Chapter 5 I investigate the drivers of SGBV. While conflict is seen as a major driver, I consider the possible effects the institutional environment (e.g the position of women in Congolese society) may have on this relationship.

1.4 Findings

The key contribution of this thesis is the application of large-n data collection to questions on drivers of development in locations where such data collection is often difficult. The discussion on these drivers above revolves around many local dynamics, such as social capital, institutions and behaviour that are difficult to measure at higher aggregate levels. However, collecting data at lower levels, through household surveys, is often difficult and costly, precisely due to other dynamics considered here, such as lack of market access and conflict. By drawing on work done as part of increased efforts to measure the impact of development programs, this thesis presents local evidence from a variety of contexts, allowing a rich and detailed picture on development.

I find that the links between risks, opportunities and development are rarely straightforward. Conflict, for example, has effects on behaviour, which in turn may affect development in unforeseen ways. In chapter 2 I present evidence that conflicted-affected youth in Sierra Leone are more likely to receive a foul card during a football game, more less averse, more altruistic towards their team-mates and more willing to compete towards members of competing football teams. These findings are in line with existing literature, and may have implications for post-conflict development.

That is of course not to say that conflict is a positive thing for development. The scars of conflicts remain visible in both Sierra Leone and DRC today, even to the most casual observer. Even so, care

should be given when attributing all problems that these countries face to the violent conflicts they underwent. One such problem is the high incidence of SGBV in Eastern DRC. Perpetration of SGBV by armed groups – as a "weapon of war" – is often seen as a crucial part of this high incidence. However, empirical evidence suggests that most SGBV is done at the hands of intimate partners (see e.g. Peterman et al., 2011). Chapter 5 complements this literature by examining the characteristics of female victims of SGBV. I find that victims are likely to be married to higher-status men and have low intra-household bargaining power. While the victims are more likely to have been exposed to violent conflict to the extent where they have lost family or household members before 2012 than non-victims, I find no link with more recent conflict history. This suggests that the issue of SGBV runs deeper than its framing as "weapon of war" suggests, and that in order to address SGBV the position of women in Congolese society needs to be improved.

Chapters 3 and 4 look at opportunities to development: markets and development aid. With respect to development aid, in chapter 3 I present evidence from an impact evaluation for a project subsidizing agricultural inputs in Eastern DRC. The evaluation found evidence that the project was successful in increasing input use among farmers: fertilizer use increased by five percentage points while use of inoculant (a novel technology aimed at increasing the amount nitrogen in the soil) increased by three percentage points. Considering the low rates of adoption in the region, these increases are large. However, we find no evidence of increased yields, or improved food security. Furthermore, we found that the improvements in input use took place in villages close to input market; in villages that were more remote uptake rates were unaffected by the subsidy program. This suggests an important role for market access in development.

That this role of market access goes beyond supplying goods vital to development is the finding of Chapter 4. We find that people living in communities with markets behave differently in an investment game. Specifically, in addition to social preferences, expectations of returns (a common indicator of trust) play a crucial in determining the amount they send. In non-market communities the amount sent is only determined by social preferences. Such trust facilitates a wide range of transactions and therefore plays an important role in development.

1.5 Methods

A common thread in all the chapters of this thesis is the use of large-scale data collection combined with novel methods to collect data that would otherwise be hard to observe. In particular, each chapter makes use of experiments to capture variables that are difficult to measure without bias using traditional methods. This includes concepts such as competitiveness and intra-village trust.

To measure the social preferences and competitiveness of the Sierra Leonean football players who are

central in the research presented in Chapter 2, I use a range of behavioural games, most prominently a standard dictator game to measure other-regarding preferences and and effort game based on Niederle and Vesterlund (2007) to measure competitiveness.

In Chapter 4 I combine an Investment Game (Berg et al., 1995) with a large scale survey to find the determinants of trusting behaviour. Such preferences would be impossible to measure without bias using survey questions, and given their importance in shaping social capital, the use of these experiments is vital in development economics (Camerer and Thaler, 1995; Cardenas and Carpenter, 2008, see e.g).

The experiment of Chapter 3 is larger in scale. The chapter draws on an RCT where rather than assigning individuals to experimental conditions, like in the behavioural games of the preceding chapters, entire villages are assigned to either a treatment condition (where they receive a subsidy) or a control condition (where they receive no such subsidy).

Finally, Chapter 5 relies on a list experiment to measure the incidence of SGBV while avoiding social desirability bias. This bias would be present in regular survey questions, because women are unlikely to talk to an interviewer about a sensitive topic like victimization. The list experiment removes this bias by removing the possibility of the interviewer (and researcher) to infer the victimization status of any individual respondent. This is done by presenting half the respondents with four problems and asking them how many of these problems they personally face. The other half of the women are presented with five problems: the same four, plus SGBV. An unbiased estimate of incidence of SGBV can thus be obtained by comparing the mean number of problems faced by both groups, as any such difference must be caused by SGBV incidence.

The ability to get unbiased estimates of competitiveness, trust, program impact and SGBV incidence is of great importance to accurately capture the way in which local dynamics, such as behaviour and institutions, mediate the link between risks and opportunities and development.

1.6 Roadmap

This thesis is structured as follows. Following this introduction, there are four chapters, each presenting results from a different research project. Chapter 2 uses data collected during a street football tournament in Sierra Leone, and examines the effect of conflict exposure on behaviour; Chapter 3 presents the results from a randomized controlled trial to assess the impact of input subsidies on agricultural production in Eastern DRC; Chapter 4 presents evidence from an investment game in Cameroon; and Chapter 5 discusses the determinants of SGBV in Eastern DRC. Following these four chapters, there are concluding remarks, synthesizing the lessons learned from each of these chapters.

1.7 Bibliography

Acemoglu, D., S. Johnson, and J. A. Robinson (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review 91*(5), 1369–1401.

Acemoglu, D., S. Johnson, and J. A. Robinson (2005). Institutions as a Fundamental Cause of Long-Run Growth. In P. Aghion and S. N. Durlauf (Eds.), *Handbook of Economic Growth*, Chapter 6, pp. 385–472. Elsevier B.V.

Akresh, R., P. Verwimp, and T. Bundervoet (2011). Civil War, Crop Failure, and Child Stunting in Rwanda. *Economic Development and Cultural Change 59*(4), 777–810.

Ansoms, A. and W. Marivoet (2009). Profil socio-économique du Sud-Kivu et futures pistes de recherche. *L'Afrique des Grands Lacs* (September), 259–271.

Ashraf, N., I. Bohnet, and N. Piankov (2006, sep). Decomposing trust and trustworthiness. *Experimental Economics 9*(3), 193–208.

Baaz Eriksson, M. and M. Stern (2013). *Sexual violence as a weapon of war? Perceptions, prescriptions, problems in the Congo and beyond*. London, UK: Zed Books.

Banerjee, A. V. and E. Duflo (2011). *Poor Economics*. New York: Public Affairs.

Bellows, J. and E. Miguel (2009). War and local collective action in Sierra Leone. *Journal of Public Economics 93*(11-12), 1144–1157.

Benenson, J. F., J. Pascoe, and N. Radmore (2007, may). Children's altruistic behavior in the dictator game. *Evolution and Human Behavior 28*(3), 168–175.

Berg, J., J. Dickhaut, and K. McCabe (1995, jul). Trust, Reciprocity, and Social History. *Games and Economic Behavior 10*(1), 122–142.

Blattman, C. (2009). From Violence to Voting: War and political participation in Uganda. *American Political Science Review 103*(2), 231–247.

Braga, J., S. J. Humphrey, and C. Starmer (2009). Market experience eliminates some anomalies-and creates new ones. *European Economic Review 53*(4), 401–416.

Burgess, R., E. Miguel, and C. Stanton (2015). War and deforestation in Sierra Leone. *Environmental Research Letters 10*, 1–10.

Camerer, C. and R. H. Thaler (1995). Anomalies: Ultimatums, Dictators and Manners. *Journal of Economic Perspectives 9*(2), 209–219.

Cardenas, J. C. and J. Carpenter (2008). Behavioural development economics: Lessons from field labs in the developing world. *Journal of Development Studies 44*(3), 311–338.

Cecchi, F. and E. H. Bulte (2013). Does Market Experience Promote Rational Choice ? Experimental Evidence from Rural Ethiopia. *Economic Development and Cultural Change 61*(2), 407–429.

Collier, P. (1999). On the Economic Consequences of Civil War. *Oxford Economic Papers 51*(January 1998), 1–16.

Collier, P., V. L. Elliott, H. Hegre, A. Hoeffler, M. Reynal-Querol, and N. Sambanis (2003). *Breaking the Conflict Trap: Civil War and Development Policy*. Washington D.C.: World Bank.

di Falco, S. and E. H. Bulte (2011). A dark side of social capital? Kinship, consumption, and savings. *Journal of Development Studies 47*(8), 1128–1151.

Easterly, W. (2007). Was development assistance a mistake? *American Economic Review 97*(2), 328–332.

FAO (2005). Country Profile - Sierra Leone. pp. 1–33.

FAO (2020). Democratic Republic of the Congo: Situation Report November 2020. Technical report, FAO.

Fehr, E., H. Bernhard, and B. Rockenbach (2008, aug). Egalitarianism in young children. *Nature 454*(7208), 1079–83.

Fischer, J. A. V. (2008). Is competition good for trust? Cross-country evidence using micro-data. *Economics Letters 100*(1), 56–59.

Henrich, J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, R. Mcelreath, M. Alvard, A. Barr, J. Ensminger, K. Hill, F. Gil-white, M. Gurven, F. Marlowe, J. Q. Patton, and N. Smith (2005). ‘ Economic Man ’ in Cross-cultural Perspective : Behavioral Experiments in 15 Small-scale Societies. *Behavioral and brain sciences 28*(6), 795–815.

Henrich, J., J. Ensminger, R. McElreath, A. Barr, C. Barrett, A. Bolyanatz, J. C. Cardenas, M. Gurven, E. Gwako, N. Henrich, C. Lesorogol, F. Marlowe, D. Tracer, and J. Ziker (2010). Markets, Religion, Community Size and the Evolution of Fairness and Punishment. *Science 327*(5972), 1480–1485.

Human Rights Watch (1999). Sierra Leone: Getting Away with Murder, Mutilation, and Rape. Technical report, New York.

Humphreys, M., R. S. de la Sierra, and P. V. D. Windt (2013). Exporting Institutions: Evidence from a Field Experiment in Eastern Congo. *Working paper*.

Iqbal, Z. (2006). Health and human security: The public health impact of violent conflict. *International Studies Quarterly 50*(3), 631–649.

Johnson, K., J. Scott, B. Rughita, M. Kisielewski, J. Asher, R. Ong, and L. Lawry (2010). Association of Sexual Violence and Human Rights Violations With Physical and Mental Health in Territories of the Eastern Democratic Republic of the Congo. *JAMA 304*(5), 553–562.

Kirby, P. (2015, may). Ending sexual violence in conflict: The Preventing Sexual Violence Initiative and its critics. *International Affairs 91*(3), 457–472.

Knack, S. and P. Keefer (1997). Does Social Capital Have an Economic Payoff? A Cross-Country Investigation. *The Quarterly Journal of Economics 112*(4), 1251–1288.

La Mattina, G. (2017). Civil conflict, domestic violence and intra-household bargaining in post-genocide Rwanda. *Journal of Development Economics 124*, 168–198.

Lecoutere, E., K. Vlassenroot, and T. Raeymaekers (2005). Conflict , institutional changes and food insecurity in eastern D . R . Congo. *Afrika Focus 22*(2), 41–63.

List, J. A. and D. L. Millimet (2008). The Market: Catalyst for Rationality and Filter of Irrationality. *The B.E Journal of Economic Analysis & Policy 8*(1), 1935–1682.

Melesse, M. B. and F. Cecchi (2015). Market Exposure and Risk Aversion : Evidence from Landed Farm Households in Ethiopia.

Morris, M., V. A. Kelly, R. J. Kopicki, and D. Byerlee (2007). *Fertilizer Use in African Agriculture. Lessons Learned and Good Practice Guidelines*. Washingtion DC: The World Bank.

Müller, C. and J. P. Tranchant (2019). Domestic Violence and Humanitarian Crises: Evidence from the 2014 Israeli Military Operation in Gaza. *Violence Against Women 25*(12), 1391–1416.

Niederle, M. and L. Vesterlund (2007). Do women shy away from competition? Do men compete too much? *The Quarterly Journal of Economics 122*(3), 1067–1101.

Peterman, A., T. Palermo, and C. Bredenkamp (2011, jun). Estimates and determinants of sexual violence against women in the Democratic Republic of Congo. *American journal of public health 101*(6), 1060–7.

Peters, K. (2011). *War and the Crisis of Youth in Sierra Leone*. Cambridge: Cambridge University Press.

Peters, K. and P. Richards (1998). 'Why We Fight': Voices of Youth Combatants in Sierra Leone. *Africa 68*(2), 183–210.

Platteau, J.-P. (1996, jan). The Evolutionary Theory of Land Rights as Applied to Sub-Saharan Africa: A Critical Assessment. *Development and Change 27*(1), 29–86.

Putnam, R. (2001). Social Capital: Measurement and Consequences. *Canadian journal of policy research 2*(1), 41–51.

Richards, P. (2005, sep). To fight or to farm? Agrarian dimensions of the Mano River conflicts (Liberia and Sierra Leone). *African Affairs 104*(417), 571–590.

Rodrik, D. (2006). Goodbye washington consensus, hello Washington confusion? A review of the World Bank's Economic Growth in the 1990s: Learning from a Decade of Reform. *Journal of Economic Literature 44*(4), 973–987.

Rodrik, D., A. Subramanian, and F. Trebbi (2004). Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development. *Journal of Economic Growth 9*(2), 131–165.

Roth, A. E. and I. Erev (1995). Learning in extensive-form games: Experimental data and simple dynamic models in the intermediate term. *Games and Economic Behavior 8*(1), 164–212.

Sachs, J. D. (2005). *The End of Poverty: Economic Possibilities for Our Time*, Volume 84. New York: The Penguin Press.

Sapienza, P., A. Toldra-Simats, and L. Zingales (2013). Understanding trust. *Economic Journal 123*, 1313–1332.

Smith, P., S. Perrin, and W. Yule (2002). War exposure among children from Bosnia-Hercegovina: psychological adjustment in a community sample. *Journal of Traumatic Stress 15*(2), 147–156.

Sutter, M. (2007, jan). Outcomes versus intentions: On the nature of fair behavior and its development with age. *Journal of Economic Psychology 28*(1), 69–78.

Tu, Q. and E. H. Bulte (2010). Trust, Market Participation and Economic Outcomes: Evidence from Rural China. *World Development 38*(8), 1179–1190.

UNDP (2020). *The Next Frontier: Human Development and the Anthropocene*.

Verwimp, P. (2012). Food Security , Violent Conflict and Human Development : Causes and Consequences.

Vlassenroot, K. and T. Raeymaekers (2008). Crisis and food security profile: The Democratic Republic of the Congo. In L. Alinovi, G. Hemrich, and L. Russo (Eds.), *Beyond Relief*, Chapter 8. Bourton on Dunsmore, UK: Practical Action Publishing.

Voors, M. J., E. E. Nillesen, P. Verwimp, E. H. Bulte, R. Lensink, and D. P. Van Soest (2012). Violent conflict and behavior: A field experiment in Burundi. *American Economic Review 102*(2), 941–964.

World Bank (2000). *The Kenya Experience*. World Bank Publications.

World Bank (2007). World Development Report 2008 : Agriculture for Development. Technical report, World Bank, Washingtion DC.

World Bank (2011). *World Development Report 2011: Conflict, Security and Development*. Washington DC: World Bank.

World Bank (2019). Strategy for Fragility, Conflict, and Violence 2020-2025. pp. 138.

World Bank (2022). World Development Indicators.

Zoomers, A. and G. Van Westen (2014). Hulp en handel: Draagt het Dutch Good Growth Fund bij aan duurzame ontwikkeling in Azië, Latijns-Amerika en Afrika? *Internationale Spectator* (7), 45–49.

Chapter 2

Conflict Exposure and Competitiveness

Abstract

We use data from a street football tournament and a series of lab-in-field experiments in post-conflict Sierra Leone to examine the impact of exposure to conflict violence on competitive behavior. We find that football players that experienced more intense exposure to violence are more likely to get a foul card during a game. In the lab we find that these individuals are significantly less risk averse and more altruistic towards their in-group (teammates). We then isolate competitiveness from aggressiveness and find that conflict exposure increases the willingness to compete towards the out-group. These results are in line with theory highlighting the role of inter-group conflict in increasing in-group cooperation while exacerbating out-group antagonism. Next to other-regarding preferences and risk propensity, changes in individual preferences for competition may impact long-run development trajectories and post-conflict recovery.

2.1 Introduction

More than two-thirds of African nations have experienced civil war during the past decades (Themnér and Wallensteen, 2014). Research in the consequences of these conflicts documents the persistent effect of violence on education (Lai and Thyne, 2007; Chamarbagwala and Morán, 2011),health and disability (Ghobarah et al., 2003; Iqbal, 2006; Iqbal and Zorn, 2010), food security and poverty (Gates et al., 2012) and the working of societies as a whole. The impacts on institutions, individual behavior and preferences

This chapter is based on: Francesco Cecchi, Koen Leuveld, and Maarten Voors (2016). Conflict Exposure and Competitiveness: Experimental Evidence from the Football Field in Sierra Leone.*Economic Development and Cultural Change (64-3)*, 405-435

are less well understood (Blattman and Miguel, 2010). There is a small but growing body of literature examining these impacts, predominantly highlighting changes in social and political preferences, such as participation in local collective action, voting and sharing both within and across communities. Evolutionary theory highlights the role of inter-group conflict in shaping pro-egalitarian parochial preferences – increasing in-group cooperation while exacerbating out-group antagonism Bowles (2006); Bernhard et al. (2006); Choi and Bowles (2007). At shorter time-scales this theory has been corroborated with respect to increased in-group cooperation after civil war Bellows and Miguel (2009); Voors et al. (2012); Gilligan et al. (2014); Bauer et al. (2014), and increased out-group antagonism (Miguel et al., 2011).

Increased out-group antagonism may impact the aggressiveness of individuals (Miguel et al., 2011), but it may also affect their willingness to compete. Taste for competition is an important non-cognitive determinant of human capital indicators, such as adult economic achievements and productivity (Niederle and Vesterlund, 2007). If less competitive people shy away from direct competition (Bartling et al., 2012), non-first-best contenders have a higher chance of winning a contest, affecting allocative efficiency (Eriksson et al., 2009). For this reason, "competitions and the right dose of competitiveness significantly determine not only the future of the individual but even the evolution of the whole species" (Leibbrandt et al., 2013). Yet, individual variations in competitiveness need not to be solely explained by genetic endowments and long-run evolution. They may be the result of exposure to different environments and pressures. Leibbrandt et al. (2013) compare individualistic and collectivistic societies, and show that life experiences may alter individual tastes for competition. In conjunction with altered preferences for local collective action and trade-offs over risk and time, shifts in competitiveness may be a crucial determinant of regional post-war political and economic recovery and development.

This paper seeks to connect and contribute to two literatures: that on the determinants of competitiveness and on the impact of civil war (which we discuss below). Several authors argue that conflict exposure during childhood affects beliefs and behavior later in life (see Adhvaryu and Fenske, 2013, for a review). Using data from a football tournament in Sierra Leone, we assess the impact of war-related violence on preferences of local youth. We carefully record the details of each match and player. After the game, we invite players to participate in a series of lab-in-field experiments and a short survey. We measure preferences towards teammates and opponents, making use of the bi-lateral antagonism and group dynamics generated by sport itself (see Weinstein et al., 1995; Duggan and Levitt, 2002; Garicano and Palacios-Huerta, 2006; Miguel et al., 2011). We find that individuals who experienced more intense conflict-related violence during childhood are more likely to receive a foul card during a football game, are less risk averse and more altruistic towards their in-group, but not towards the out-group. Next, we test willingness to compete through an effort game that disentangles competitiveness from aggressiveness. Out-group competitiveness appears to be exacerbated by violent conflict: conflict exposed subjects are

on average 51% more likely to enter a competition against an out-group than the non-exposed.

Obviously, it is challenging to identify the exact mechanisms through which conflict affects behavior. We argue that our results are consistent with a perspective on how conflict changes preferences and beliefs. To probe the robustness of our results we run several checks. First, we investigate self-selection into violence and find little evidence of it—consistent with literature on the Sierra Leonean civil war. Next, we show that age-group fixed effects (plausibly correlated with war exposure) do not alter our main result. Also, we probe whether our results are driven by temporary migration: our main coefficient remains stable and is not significantly different across war time migration destinations. In addition, our main result is robust to the introduction of forced displacement as an additional source of war-related trauma, as well as to football match and team fixed effects, and clustering standard errors at the football team level. Finally, willingness to compete may also be a function of risk preferences, expected relative performance, and actual skills. We show that our result maintains when controlling for these covariates both separately and jointly.

The study is organized as follows. Section 2.2 discusses literature on conflict and preferences and on the determinants of competitiveness and presents our key hypothesis. Section 2.3 presents the context and background of civil war in Sierra Leone and of our study area in particular. Section 2.4 introduces the field and lab experimental data, and outlines the experimental design and data. Section 2.5 discusses our identification strategy and Section 2.6 contains our results. Section 2.7 offers a discussion and conclusion.

2.2 Conflict, preferences and competition

Competitiveness is a key determinant of individual economic achievements and productivity (Niederle and Vesterlund, 2007). There are significant differences in willingness to compete both within and across societies (Leibbrandt et al., 2013). These differences can are attributed to variations in genetic endowments, abilities and preferences (Niederle and Vesterlund, 2007; Gneezy et al., 2009) as well as individual exposure to various environmental pressures and life events (Roth and Erev, 1995). Most empirical studies on the origins and consequences of competitiveness use data from laboratory experiments. Using effort games, behavioral economists document that when the type of payment is exogenously imposed on subjects, competitive tournaments reveal a much larger variance of effort than equivalent piece-rate schemes (Van Dijk et al., 2001; Harbring and Irlenbusch, 2003). This in turn reduces their overall efficiency (Eriksson et al., 2009). Such an unexpected finding may be driven by the unwillingness of some people to enter competition. In fact, Eriksson et al. (2009) show that allowing for self-selection into a competitive tournament results in higher average effort rates and lower between-subject variance for subjects choosing to compete. Competitive environments are thus more efficient than non-competitive

ones only if populated by a sufficient share of agents willing to compete.

While a complete insight is lacking, literature has highlighted several individual and behavioral determinants of competitiveness. For example, Niederle and Vesterlund (2007) find important differences with respect to gender and performance expectations. Bartling et al. (2009) find that overconfident, skilled and risk prone subjects are more likely to join a contest, while inequality-averse subjects less. Leibbrandt et al. (2013) find that fishermen from individualistic societies are far more competitive than those from neighboring collectivistic societies, and that this difference emerges with time. Individuals shape their preferences mostly during childhood (Benenson et al., 2007; Fehr et al., 2008), and continue to develop them till early adulthood (Sutter, 2007). Intense shocks during childhood should thus alter individual preferences for competition. Yet, the role of early life events such as exposure to conflict as a determinant of competitiveness is still ill-understood. Research into conflict induced changes in behavior is equally limited but growing (Blattman and Miguel, 2010).[1] A key research line focusses on the impacts on pro-social preferences. An emerging insight points to the boundary between in-groups relative to out-groups in shaping post conflict preferences: intra-community violence appears to decrease within community social cohesion whereas inter-community conflict increases it. This mirrors contributions in evolutionary theory, which predicts how inter-group conflict shapes parochial preferences—increasing in-group cooperation while exacerbating out-group antagonism (Bowles, 2006; Bernhard et al., 2006; Choi and Bowles, 2007). For example, Cassar et al. (2013) find that intra-community violence in Tajikistan undermined social cohesion and in-village trust (see also Rohner et al., 2013). On the other hand, Bellows and Miguel (2009) find that Sierra Leoneans whose households directly experienced more intense violence by the RUF are more likely to attend community meetings, join local political and community groups, and vote. Blattman (2009) finds that experiencing abduction and violence increased political engagement, voting and community leadership among ex-combatants in Northern Uganda. Blattman and Miguel (2010) present a survey of literature on civil war and argue that the existing literature omits advances in behavioral economics, and advocate micro-level analysis and case studies as crucial to understand war's causes, conduct, and consequences, in particular in the behavioral and institutional domain.

In recent years, a number of studies have used lab-in-field experiments to gauge the consequences of civil wars. Voors et al. (2012) show that individuals exposed to violence display more altruistic behavior towards their neighbors, are more risk-seeking, and have higher discount rates. Gilligan et al. (2014) show that communities that suffered war-related violence during Nepal's ten-year civil war ex-

[1]Psychological literature documents the relationship between war exposure and trauma, focusing mostly on post-traumatic stress disorder (PTSD), anger and anxiety. Macksoud and Aber (1996) examine the relation between war traumas and psychosocial development, finding that the number of war traumas experienced by a child was positively related to Post Traumatic Stress Disorder (PTSD) symptoms and differentially related to other behavioural outcomes. Smith et al. (2002) and Layne et al. (2010) identify similar attitudinal outcomes among conflict exposed children in Bosnia, while Dyregrov et al. (2002) find highly time-persistent intrusive and avoidance reactions among Iraqi children exposed to a deadly aerial bombing. Other studies explore instead positive responses to trauma—often referred to as "post-traumatic growth" (Tedeschi and Calhoun, 1996; Powell and Rosner, 2003; Staub and Vollhardt, 2008; Vollhardt, 2009).

hibit significantly greater levels of altruistic giving, public good contributions, investment in trust-based transactions, and willingness to reciprocate trust-based investments. Bauer et al. (2014) investigate how conflict experiences shape the beliefs and preferences of youth. They present two case studies – one in Georgia and one in Sierra Leone – indicating that experiencing inter-group conflict during childhood and adolescence increases egalitarian motivations toward the in-group, but not the out-group. The only work that explicitly investigates behavioral changes in out-group antagonism is Miguel et al. (2011), who examine the consequences of civil war on aggressiveness of players in European football leagues. They find that the number of years the home country of a player has been in violent conflict before the player reaches the age of eighteen is strongly and positively related to the amount of foul cards received. We build on work by Miguel et al. (2011), and combine data from a field setting – the football tournament – and lab-in-the-field experiments. After providing confirmatory evidence of increased aggressiveness and increased parochial altruism, we test willingness to compete through a competitiveness game that disentangles competitiveness from aggressiveness—i.e. a player's choice to compete may only affect his own payoff, not that of other players. While the role of conflict exposure in shaping social preferences has been explored in several experimental settings, to our knowledge this is the first work attempting to investigate its effect on competitiveness.

2.3 Background: the Sierra Leone civil war

We use data from a sample of respondents in Kenema, a regional town in Eastern Sierra Leone. Sierra Leone is amongst the poorest countries in the world recovering from an eleven years long civil war (1992-2001). At its start, a small group of rebels entered the East of the country. They found fertile ground for popular grief and discontent towards "a decayed neo-patrimonial one-party regime" (Richards, 1999) and were nurtured by Sierra Leone's diamond wealth (Keen, 2005). It was the start of a country-wide civil war that cost over 50,000 lives, leaving many civilians amputated and abused, and hundreds of thousands temporarily displaced (Human Rights Watch, 1999; Doucet and Denov, 2012).

Kenema is the gateway to the eastern provinces and forested Liberia border area. The district saw many conflict events throughout the war; in fact the "Zogoda", RUF's headquarters, was only about 30 km from Kenema (Peters, 2011). While there were many parties involved in violence in the war, most was committed by the RUF (Conibere et al., 2004). The conflict in Kenema can be separated in three phases: the initial incursion and consolidation by the RUF (1991-1993), clashes between Civil Defence Forces (CDF, or Kamajors) and the RUF , up to 1997, and a final phase which saw widespread intervention by ECOMOG, from 1997 – 2000. During all phases of the war, most violence was motivated either to cause fear and panic or to obtain supplies by the belligerent parties, both resulting in indiscriminate violence

against civilians. During so-called "food finding missions" houses were looted and burned (for a broader discussion on such tactics, refer to Kalyvas Kalyvas, 2006). Civilians were regularly captured to work in mines, raped, or mutilated. A report submitted to the Special Court for Sierra Leone (Smith et al., 2004) describes the events in detail. During a typical attack "RUF forces fired indiscriminately at civilians, who were running here and there, dazed and confused, killing dozens. Many houses were burnt and massive looting was carried out, with people of the town being forced to carry the stolen property" (Smith et al., 2004, p. 303). The most notable direct attack by RUF forces took place on Christmas Day in 1994. The attack, which lasted several days, resulted in the deaths and abduction of hundreds of civilians. Later in 1997, when the RUF briefly ruled the town, "girls were raped, houses were looted continuously and civilians were harassed for food and other items" (Smith et al., 2004, p. 318). These events reflect the national patterns of conflict, where most violence was not motivated by religious or ethnic cleavages (see Bellows and Miguel, 2009), and no ethnic group was disproportionally targeted by rebels (Conibere et al., 2004; Humphreys and Weinstein, 2006).[2] Most of our respondents lived in Kenema during the conflict. Figure 2.1 shows the distribution over time of conflict related events, war exposure and conflict induced displacements, of our sample. As a confirmatory exercise we have plotted the recorded violent events in Kenema from the SLL-LED dataset (Bruijne, 2014) in the figure as well. Two peaks, in 1994 and 1997-1998 overlap with exposure and displacement events in our sample. Over 82% of our respondents were (temporarily) displaced at least one time during the conflict. This is comparable to the nationally representative wartime displacement rates in the 2007 Institutional Reform and Capacity Building Project dataset used in Bellows and Miguel (2009). While some of our respondents moved to places out of Sierra Leone (neighboring Guinea and Liberia), most displacements where within Kenema district (51.1%) or adjacent districts (11.9%).

Disarmament started at the end of 2001 and President Kabbah declared the war over in January 2002 Peters (2011). RUF and other armed groups were disarmed, demobilized and reintegrated in society. At present violence and intimidation have disappeared from Sierra Leone and the country has now known several years of peace. While the country still ranks low on close to all development indicators, the local economy is improving each year—the 2013 GDP growth rate was close to 13%.

[2]See Section 2.5 for a further discussion and analysis.

2.4 Data and experimental design

Our data was collected during a youth street football tournament organized in Kenema. The tournament spanned several weeks between November and December 2010. For the tournament, streets within the city each assembled in a team. Matches were centrally organized and a substantial cash reward awaited the winner. Team identity was strong and the players took pride in defending their street. Referees oversaw adherence to rules and distributed yellow and red cards in response to minor and major fouls.[3] We carefully recorded details of the matches and players of the performance of 14 teams and 162 players. Table 2.1 presents the descriptive statistics (see Appendix I for variable definitions). A total of 47 yellow and 3 red cards were given, involving 20% of the players. After each football match, we invited players to participate in a survey and a series of lab-in-field experiments. Our close collaboration with tournament organizers and team managers effectively cancelled attrition.

Table 2.1: Descriptive Statistics

	count	mean	sd	min	max
Exposure to conflict	162	0.57	0.26	0.00	1.00
Parent fought in war	162	0.12	0.33	0.00	1.00
Age	162	19.75	3.44	14.00	31.00
Education Level	162	2.64	0.75	1.00	4.00
Meals per day	162	2.44	0.63	1.00	3.00
Muslim	162	0.79	0.41	0.00	1.00
Mende	162	0.54	0.50	0.00	1.00
Fula	162	0.16	0.37	0.00	1.00
Mandingo	162	0.11	0.32	0.00	1.00
Temne	162	0.07	0.26	0.00	1.00
Always in Kenema	162	0.52	0.50	0.00	1.00
Foul card	162	0.20	0.40	0.00	1.00
Played whole game	162	0.46	0.50	0.00	1.00
Self-declared skills	162	0.86	0.23	0.00	1.00
Scored	162	0.17	0.38	0.00	1.00
Won the football game	162	0.42	0.50	0.00	1.00
Left footed	162	0.19	0.39	0.00	1.00
Risk Preferences	162	0.00	1.00	-1.56	1.19
Sharing in out-group dictator game	162	-0.27	1.09	-3.43	2.39
Sharing in in-group dictator game	162	0.27	0.81	-2.70	3.84
Outgroup Tournament	70	0.43	0.50	0.00	1.00
Ingroup Tournament	92	0.41	0.50	0.00	1.00
Expected performance	162	0.91	0.13	0.60	1.00
Balls on target	162	6.27	1.82	1.00	10.00

Notes: See Appendix I for variable definitions.

Our respondents are young males, between 14 and 31 years old (see Figure 2.2A). They are predomi-

[3]Two referees oversaw all the football games. The referees were semi-professional and provided by the organisation of the tournament (a youth association in Kenema). One could worry that the referees systematically favoured one team over the other based on its composition. We have no reason to believe this is the case, but cannot rule this out completely. Unfortunately, we did not collect information about the referee's background, ethnic group, and individual characteristics.

nantly Muslim, and of the Mende tribe and 50% are enrolled in senior secondary education. We identify a series of plausible non-experimental proxies of sportive ability, which may influence the willingness to compete and to receive a foul card. Substitutes could enter and exit at any time of the match, with no limit with respect to the number of substitutions. Therefore, whether a player had not been substituted during the entire duration of the match (46%) may be seen as a good approximation of relatively greater football skills, most likely correlated to general sportive ability. In addition, we ask our respondents to rate their own level of skills compared with their teammates. We create an index ranging from 0 (self-declared least skilled) to 1 (self-declared most skilled). While we could not record the positioning of players on the football field due to the high fluidity of play, we also recorded which players scored a goal. Finally, we recorded which team won the football game,[4] and if the participant is left or right footed.[5]

To measure exposure to conflict-related violence we ask respondents about a range of war related events, covering information on personal injury, seeing injured people, seeing and hearing combat.[6] Following Bellows and Miguel (2009), we create a victimization index using the average of positive responses to these violence related questions. On average, our respondents experienced 57% of such events.[7] Figure 2.2B shows the average conflict exposure by age in our sample. Younger generations are relatively less victimized, but overall victimization follows a rather clear quadratic trend across age groups (a more detailed discussion on this can be found in Section 2.5).

We implement a range of lab-in-field experiments. We measure willingness to self-select into competitive environments using an effort game, based on Niederle and Vesterlund (2007) and Bartling et al. (2009). Respondents are invited to participate in a game where they throw a football into a standard sized basket secured to the floor, from a distance of four meters. They choose whether to play individually – at a piece rate payment scheme of 500 Leones per ball on target – or to enter a competition against an anonymous counterpart. In the competition, the respondent wins 1500 Leones for every ball on target if the total number of hits is higher than the counterpart—zero if lower.[8] In case of a draw with the counterpart the respondent receives 500 Leones per ball on target. It is possible for one player

[4]The decision of entering the competition may be influenced by the expected ability of the counterpart. Participants could only estimate team-level ability at the team level, as counterparts are anonymous, which is proxied by winning the football game. Also, winning the football game may have implications for the morale and overconfidence of participants.

[5]Psychological literature highlights correlations between handedness and several non-cognitive dimensions (Goldberg et al., 1994) as well as cognitive skills (Sanders et al., 1982; Faurie et al., 2006). More recently, handedness has been placed in correlation with economic outcomes (Denny and O'Sullivan, 2007) and competitiveness (Hoffman and Gneezy, 2010). Less attention has been devoted specifically to footedness. However, footedness is strongly correlated with handedness – especially for right-handers (Peters and Durding, 1979) – and Elias et al. (1998) find it to be a more accurate predictor than handedness of emotional lateralization.

[6]In a robustness check we include displacement as an additional element of the victimization index. As 82% of our sample was temporarily displaced at least once during the conflict, this brings average victimisation up to 0.63 (0.24). See section 2.6 for the implications of this change for our results.

[7]This statistic is similar to what Bellows and Miguel (2009) find in their study. Note that, as our measure of war exposure is self-reported, one may worry that types of respondents have a different propensity to report on war time events. If this is correlated with our outcome variables, then our estimates are biased. While we cannot exclude such possibility, our data show consistent patterns results for those reporting high and low levels of conflict exposure reducing concerns over bias in reporting.

[8]4400 Leones were about 1 USD at the time of data collection.

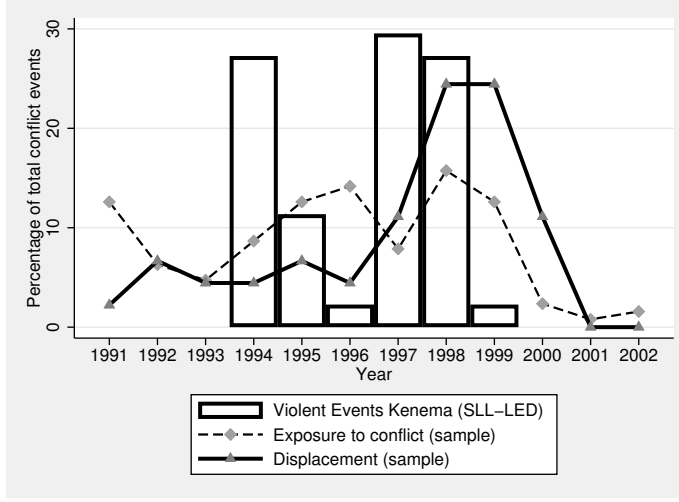


Figure 2.1: Exposure to conflict, and displacement in our sample over time, combined with SLL-LED attacks events in Kenema District over the same time period.

Notes: distribution of SLL-LED events in Kenema (Bruijne, 2014), conflict events reported by participants and displacement events reported by participants over the course of the war in Sierra Leone. All data is presented as column totals, so about 25% of all displacement events took place in 1998.

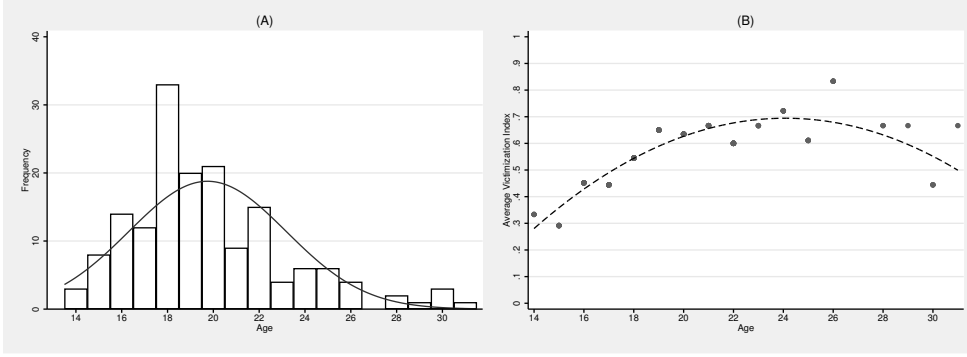


Figure 2.2: Age in sample and exposure to conflict

Notes: panel A shows the distribution of age in our sample. Panel B shows the relationship between age and victimization index.

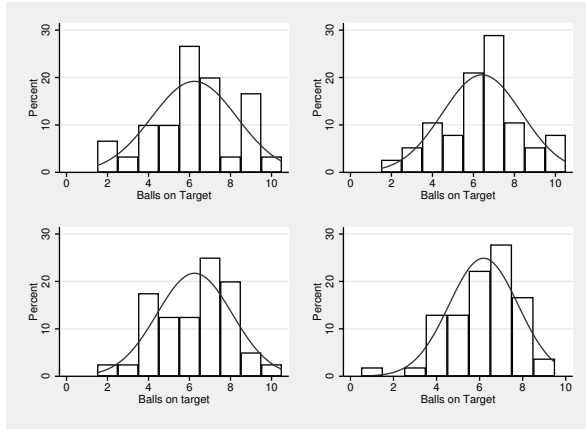


Figure 2.3: Balls hit in the effort game

Notes: distribution of number of balls hit for four subsamples: Panel A: Out-group, opted for tournament; Panel B: In-group opted for tournament; C: Out-group, did not opt for tournament; D: In-group, did not opt for tournament

to enter the competition even if the counterpart does not, and vice versa. As a result, the payout of one player is determined only by his choice to compete and by the number of balls on target relative to the anonymous counterpart.[9] In other words, participants cannot influence or hurt their opponents' utility and earnings by choosing to enter the competition—but only by being better, regardless of their choice to compete or not. This setup allows us to disentangle willingness to compete from aggressiveness, as the decision to compete or not taken by each participant only affects their own private outcome, and not that of the counterpart. Respondents are randomly divided into two groups: one group plays against an anonymous player of the opponent team (out-group) and another against an anonymous player of their own team (in-group). 42% of the respondents chose to participate in the tournament. Figure 2.3 shows the distribution of balls on target and relative frequency across groups. On average, respondents scored 6.27 hits (out of 10 tries), with a standard deviation of 1.82.[10]

To measure risk preferences, we use a simple dichotomous choice game based on Harbaugh et al. (2002). In this risk game subjects are required to choose several times between receiving an amount of money for certain and playing a simple gamble. Six choice sets are presented; each time we ask whether the respondent prefers (1) to toss a coin and make the chance of winning 3000 Leones or zero (if tails), or (2) not toss a coin and win an amount of money for certain, growing in each choice set, from 100 Leones to 2500 Leones. The expected value of the gamble is thus kept constant, while the certain option

[9]For example, even if player 1 decides to not compete, player 2 would get zero pay-out in case player 2 decides to compete and scores less than player 1. Oppositely, even if player 1 decides to compete, player 2 would not lose if he decides not to compete.

[10]To control for expected performance in a sensitivity analysis, we ask respondents to assess their expected performance prior to playing the game. We create an index ranging from 0 (self-declared worst expected performance) to 1 (self-declared best expected performance).

Table 2.2: Risk Propensity Game Choice Sets

	Coin Toss		
Choice set	If heads	If tails	For certain
1	3000	0	100
2	3000	0	500
3	3000	0	1000
4	3000	0	1500
5	3000	0	2000
6	3000	0	2500

Notes: monetary amounts are reported in Leones. The exchange rate at the time of data collection was about 4400 Leones to 1 USD.

increases progressively: the point of switch from the gamble to the certain option is used to determine the risk preferences of the respondent (see Harbaugh et al., 2002) — the later the switch, the less risk-averse (Table 2.2). We then standardize the resulting discrete variable to improve the interpretability of the findings.

To gauge other-regarding preferences we use a simple non-strategic dictator game. Each participant made two choices about how to allocate a given endowment, once paired with a teammate and once with an opponent, in random order. Players received 1000 Leones and were told these were theirs to keep at the end of the experiment. Alternatively, they could donate any 50 Leones portion of it to an anonymous counterpart. To avoid income effects potentially confounding our results, participants were notified that their final pay-off would be determined by the outcome of one randomly selected game they played, plus a possible donation from either a teammate or an opponent. Also in this case, we standardize out-group and in-group donations for the sake of interpretability.

2.5 Identification and empirical strategy

Our empirical strategy relies on local comparisons across war and non-war exposed subjects. The key identifying assumption is that exposure to violence was exogenous with respect to individual characteristics. This assumption may be violated in the presence of systematic targeting by belligerents along some individual dimension—i.e. religion, ethnic group, etc. While undoubtedly some elements of violence were targeted, most violence in Sierra Leone was essentially a random process (Conibere et al., 2004; Humphreys and Weinstein, 2006; Bellows and Miguel, 2009)). To test these assumptions on our own sample of respondents, below we regress war exposure on a set of variables capturing individual

characteristics.[11] We find no evidence of selective violence, except for age (and age squared); responding to intuition, older participants faced a higher probability of war exposure (Table 2.3 and Figure 2.2B).[12]

Previous experimental evidence shows that children develop their preferences mostly between the age of three and eight (Benenson et al., 2007; Fehr et al., 2008), reaching stability around the early twenties (Sutter, 2007). Our sample's mean age at the beginning of the civil war was less than one-year-old, eleven by the end of it. War exposure hence occurred at a young age. This provides additional supporting ground for the causal relationship between exposure to violence during childhood, and the behavioral changes we observe. If anything, given the slightly wider age range, we are likely to underestimate the true impact of exposure to war violence. Nonetheless, the absence of base-line behavioral data – rarely available for this type of studies – makes it impossible to completely rule out potential correlations between pre-war parental behavioral characteristics and the degree of war exposure experienced by children.

Additionally, results could be biased due to selective migration. If displaced people are significantly different from people who did not migrate, selective migration might play a role in determining who experienced violence, as well as the composition of communities.[13] Gilligan et al. (2014) identify two mechanisms through which war may impact social preferences: (1) a collective coping mechanism by which people band together to deal with threats, and (2) a purging mechanism by which less social individuals disproportionately flee communities. In our case, more competitive people may have permanently migrated into Kenema, and less competitive people may have migrated out of Kenema and would therefore not be part of the investigation. Our study focuses on comparisons across individuals that have experienced varying degrees of war exposure and are currently residing in Kenema. It does not attempt to draw conclusions on the overall intent-to-treat impact of the Sierra Leone civil war on the competitiveness and willingness to compete of Sierra Leoneans, nor does it expect to generalize the conclusions across countries.[14]

The core of our analysis lies in a set of regressions that seek to explain differences in our outcome variables through a set of individual and football-related characteristics, and our measure of exposure

[11] Our sample does not include traditional authority households – significantly more likely to experience violence during the civil war according to Bellows and Miguel (2009). We do have information on participation in civic defence forces (CDF). Individuals whose parents participated in CDFs or independently fought during the civil war may have experienced more violence. In particular, if those individuals were more competitive, and competitive behaviour is correlated across generations, the main coefficient might reflect selection rather than the treatment effect of exposure to violence. Columns 3 and 4 of Table 2.3 show how there is no evidence of a significant self-selection effect into war related violence for the children of combatants. Also, Column 4 highlights how war exposure does not significantly correlate with any of the proxies for athletic ability identified during the football game.

[12] Of course, there may be selection bias due to unobservable characteristics not captured in our data, for example ethnic or political cleavages may make people more prone to be targeted. If political cleavages are related to competitive behavior, then this will bias our estimates. While we cannot rule out such hypotheses entirely, the nature of violence in Sierra Leone does not indicate such cleavages matter for victimization, and the results of Table 2.3 seem to indicate homogeneous victimization across ethic groups (see also Bellows and Miguel, 2009).

[13] According to the UN, from April 2001 to November 2002, all the 223,000 registered IDPs were reintegrated within their original communities and many more unregistered refugees have been returning home ever since (Norwegian Refugee Council, 2003).

[14] For a complementary perspective on war exposure across countries in Africa, see Adhvaryu and Fenske (2013).

Table 2.3: Exposure to Conflict

	(1)	(2)	(3)	(4)
Age	0.196***	0.172***	0.193***	0.160***
	(0.0528)	(0.0558)	(0.0529)	(0.0564)
Age squared	-0.00407***	-0.00358***	-0.00400***	-0.00326**
	(0.00121)	(0.00127)	(0.00122)	(0.00128)
Muslim		0.000515		0.0224
		(0.0464)		(0.0523)
Mende		0.0252		0.0327
		(0.0607)		(0.0648)
Fula		-0.0952		-0.0727
		(0.0843)		(0.0905)
Mandingo		-0.0859		-0.0662
		(0.0893)		(0.0978)
Temne		-0.0555		-0.0677
		(0.0955)		(0.0968)
Always in Kenema				0.0293
				(0.0383)
Education Level				0.000328
				(0.0313)
Meals per day				-0.0489*
				(0.0288)
Left footed				0.0455
				(0.0557)
Played whole game				-0.0105
				(0.0400)
Self-declared skills				0.105
				(0.0848)
Scored				-0.00805
				(0.0527)
Won the football game				-0.0236
				(0.0409)
Parent fought in war			0.0529	0.0474
			(0.0584)	(0.0630)
Constant	-1.668***	-1.364**	-1.639***	-1.273**
	(0.565)	(0.615)	(0.566)	(0.615)
N	162	162	162	162
R2	0.151	0.188	0.156	0.218

Notes: Ordinary Least Squares regressions. Robust standard errors in parentheses. Column 1 reports the marginal effect of age and age squared on exposure to conflict related violence (as measured by the individual victimization index, see Appendix I for variable definitions). Column 2 adds individual controls. Column 3 tests for the effect of active parental belligerence at any moment and for any faction during the civil war. Column 4 includes education, number of meals per day, and a series of football related variables as additional controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

to war violence. We set out by assessing the probability a player received a foul card, and compare individuals who experienced conflict to those who did not:

$$FoulCard_i = \beta_1 + \beta_2 War_i + \beta_3 X_i' + \beta_4 S_i' + \epsilon_i \tag{2.1}$$

where $FoulCard_i$ is a dummy taking value of 1 if the player i received at least one foul card during the football game (where i=1,...,162), War_i is our victimization index, X_i' a vector of individual characteristics and S_j' is a vector of football match related controls, including our self-declared skills index.

We continue by examining the impacts of violence in a series of lab-in-field experiments:

$$Risk_i = \beta_1 + \beta_2 War_i + \beta_3 X_i' + \beta_4 S_i' + \epsilon_i \tag{2.2}$$

,

$$Donation_i = \beta_1 + \beta_2 War_i + \beta_3 X_i' + \beta_4 S_i' + \epsilon_i \tag{2.3}$$

where $Risk_i$ refers to individual risk propensity, $Donation_i$ to the portion of endowment donated in the dictator game, to an anonymous teammate or opponent, and other notations are the same as in (2.1).

Finally, we empirically investigate the effect of war-related violence exposure on the willingness to compete:

$$Cometition_i = \beta_1 + \beta_2 War_i + \beta_3 X_i' + \beta_4 S_i' + \epsilon_i \tag{2.4}$$

where $Competition_i$ takes value of 1 if the participant has opted for the competitive choice, 0 if he opted for the piece-rate payment in the effort game. All other notations are as in (2.1).

Table 2.3 and Figure 2.2B show that age is a strong predictor of exposure to conflict related violence. In our model we include age and age squared as controls, and to rule out that age is driving our main result we include age fixed effects, as well as 2-year, 3-year and 4-year age-group fixed effects in a robustness check. In a further sensitivity analysis, we assess whether selective migration explains our results. We split the sample between participants that never left Kenema district,[15] and those who (temporarily) migrated outside Kenema district. Next, we include forced displacement as an additional source of war-related trauma, football match fixed effects, team fixed effects, and team-level clustering of standard errors. As final robustness check, we include measures of performance expectation, skills, and risk preferences (Niederle and Vesterlund, 2007; Bartling et al., 2009). In addition to self-declared football skills and playing the whole football game – proxies of sportive ability in general – we add expected relative performance in the effort game, a standardized measure of the actual number of balls

[15]This includes participants who had been displaced but always remained within Kenema district.

on target, and our measure of risk preferences, into equation (2.4).

2.6 Experimental results

We start by analyzing our football field data. We find that individuals strongly exposed to conflict-related violence are 28% more likely to commit a card-deserving foul during the football game, significant at $\alpha = 0.05$ (Table 2.4, columns 1-2).[16] Next, we regress violence exposure on our standardized measure of risk propensity. We find that it increases the propensity to risk by around 2/3 of a standard deviation (Table 2.4, columns 3-4).[17]

We test the hypothesis that individual war exposure fosters parochial pro-egalitarian preferences. Indeed exposure to conflict-related violence increases in-group donations by 1/2 to 2/3 of a standard deviation (Table 2.5, columns 3-4). On the other hand, war exposure does not seem to significantly alter altruistic behavior towards out-groups (Table 2.5, columns 1-2), although the interaction term does not enter significantly (Table 2.5, column 5). In other words, in-group sharing is significantly higher when war exposure is high, while out-group sharing is harder to interpret. We can neither reject the null that altruistic behavior towards out-group is unrelated to conflict nor the null of indifference across groups. In light of the small sample size this is likely indicative of relatively low power.

Our main results on the relationship between civil war exposure and competiveness is presented in Figures 2.4A-D and Table 2.6. Figure 2.4A shows the percentage of football players receiving a foul card during the football tournament for each level of war exposure. We find that higher levels of conflict exposure are associated with a higher propensity to receive a foul card (at the median of all covariates). None of the unexposed players received a foul card. While indicative of increased out-group antagonism, this result per se is not symptomatic of increased willingness to compete. We therefore proceed to look into our laboratory style competitiveness experiment. We find that the results parallel the field setting: across the two treatments, 18% of the completely war unexposed respondents decide to join the competition, compared to 64% of the fully war exposed respondents (Figure 2.4B). A Pearson χ^2 test on the pooled dataset strongly rejects the null hypothesis of independence between war exposure and choosing to compete (p=0.003). Figure 2.4C and 2.4D show a breakdown for subjects playing against the out-group and those playing against the in-group respectively.

We find that war exposure results in out-group competition. At the median of all covariates, subjects most exposed to conflict-related violence are 51% more likely to join a competition against the out-group,

[16] A Pearson χ^2 test on victimization strongly rejects the null hypothesis of independence between war exposure and receiving a foul card (p=0.02).

[17] 17 out of 162 respondents do not meet the Single-Crossing Property (SCP), switching twice between options. Dropping these from the analysis does not change our the results, the coefficient for exposure to conflict is 0.542 (0.316), significant at 10%.

Table 2.4: Aggressiveness and Risk Propensity

	(1) Foul Card	(2) Foul Card	(3) Risk Propensity	(4) Risk Propensity
Exposure to conflict	0.266**	0.284**	0.579**	0.635*
	(0.125)	(0.133)	(0.281)	(0.340)
Age		-0.0305		0.0977
		(0.0824)		(0.202)
Age squared		0.000469		-0.00203
		(0.00185)		(0.00445)
Education Level		0.0419		-0.0895
		(0.0493)		(0.128)
Meals per day		0.0456		0.0831
		(0.0490)		(0.136)
Muslim (d)		-0.0822		0.127
		(0.0912)		(0.210)
Mende (d)		0.0814		-0.0415
		(0.0611)		(0.179)
Played whole game (d)		0.0835		0.104
		(0.0643)		(0.170)
Self-declared skills		-0.231*		0.0158
		(0.123)		(0.345)
Scored (d)		0.166*		-0.120
		(0.0990)		(0.222)
Won the football game (d)		0.175**		-0.216
		(0.0684)		(0.162)
Left footed (d)		-0.108**		0.0975
		(0.0518)		(0.205)
N	162	162	162	162
Pseudo R-Squared	0.025	0.157		
R2			0.022	0.054

Notes: Probit marginal effects in (1) and (2), Ordinary Least Squares estimates in (3) and (4). Column 1 reports the univariate marginal effect of exposure to conflict on the likelihood of having received at least one foul card. Column 2 adds individual and football game related controls. Column 3 reports the univariate marginal effect of exposure to conflict on an experimental measure of risk propensity (see Appendix I for variable definitions). Column 4 adds individual and football game related controls. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.5: Dictator Game Donations

	(1) Out-group	(2) Out-group	(3) In-group	(4) In-group	(5) Pooled
Exposure to conflict	0.293	0.188	0.443*	0.619**	0.329
	(0.394)	(0.401)	(0.238)	(0.278)	(0.393)
Ingroup					0.465*
					(0.278)
Exposure to conflict × in-group					0.150
					(0.464)
Age		0.219		-0.0491	0.0849
		(0.188)		(0.153)	(0.123)
Age squared		-0.00369		0.000162	-0.00176
		(0.00410)		(0.00329)	(0.00272)
Education Level		-0.0444		0.0271	-0.00865
		(0.115)		(0.0994)	(0.0764)
Meals per day		0.292*		-0.00494	0.144
		(0.171)		(0.111)	(0.106)
Muslim		0.129		0.0459	0.0877
		(0.223)		(0.138)	(0.134)
Mende		-0.0518		-0.149	-0.100
		(0.170)		(0.129)	(0.107)
Played whole game		0.216		-0.0103	0.103
		(0.188)		(0.140)	(0.117)
Self-declared skills		0.244		0.480**	0.362
		(0.404)		(0.206)	(0.227)
Scored		-0.163		0.0693	-0.0468
		(0.239)		(0.177)	(0.149)
Won the football game		0.0635		0.143	0.103
		(0.180)		(0.140)	(0.115)
Left footed		0.0639		0.189	0.126
		(0.239)		(0.178)	(0.147)
Constant	-0.442*	-4.210*	0.0226	0.299	-2.188
	(0.247)	(2.184)	(0.119)	(1.523)	(1.392)
N	162	162	162	162	324
R2	0.005	0.088	0.020	0.097	0.117

Notes: Ordinary Least Squares regressions. Column 1 reports the univariate marginal effect of exposure to conflict on dictator game donations towards the out-group (see Appendix I for variable definitions). Column 2 adds individual and football game related controls. Column 3 reports the univariate marginal effect of exposure to conflict on dictator game donations towards the in-group. Column 4 adds individual and football game related controls. Column 5 reports the pooled marginal effect of exposure to conflict on dictator game, including individual and football game related controls, a group dummy, and an interaction term. Robust standard errors in parentheses. 162 individual-level clusters in (5). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

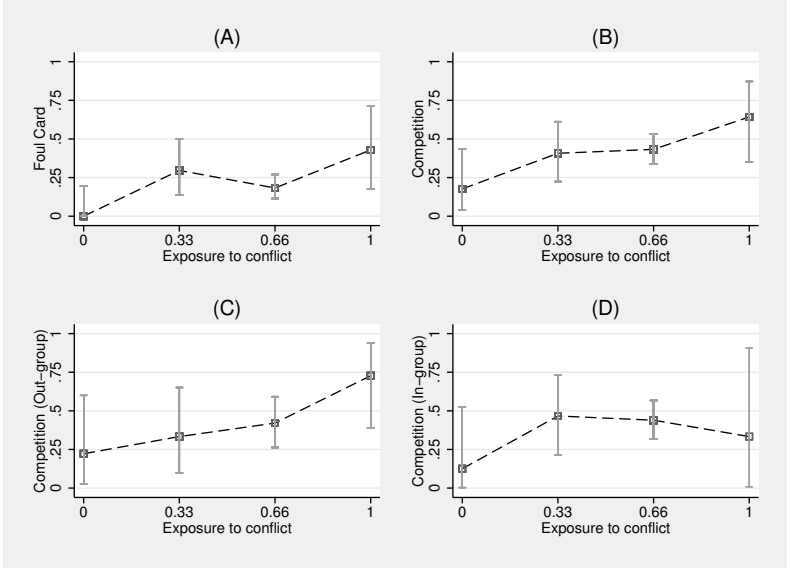


Figure 2.4: Foul cards, competitiveness and exposure to violence

Notes: Competition and war expose: Panel A: Foul Card and war exposure for the entire sample; Panel B: willingness to compete and war exposure, entire sample; Panel C: willingness to compete and war exposure, out-group only; Panel D: willingness to compete and war exposure, in-group only. All panels show binomial confidence intervals at the 95% level.

significant at $\alpha = 0.05$ (Table 2.6, columns 1-2).[18] On the other hand we cannot reject the null of no effect for in-group competitive behavior (Table 2.6, columns 3-4), as well as across groups (Table 2.6, column 5).[19]

To probe the robustness of this result we run several additional analyses. As mentioned in the previous section, our results may be driven by age. In Table 2.6, column 2 we control for age and age squared. In Appendix Table 2.A1 we run a more flexible specification of the regression—adding age and age-group fixed effects. The coefficient of conflict exposure remains stable and robustly significant. Next, we assess whether selective migration drives our result. In Appendix Table 2.A2 we separate participants that never moved out of Kenema district from those who did. The coefficient on the two separate groups is stable (Table 2.A2, columns 1-2), and the interaction term insignificant (Table 2.A2, columns 3-4).[20] This attenuates the concern that our results are due to selective migration patterns. In addition, our results are robust to the introduction of forced displacement as an additional source of war-related trauma, as well as football-match fixed effects, team fixed effects and clustering standard errors at the football team level (see Appendix Table 2.A3). Finally, while we control for proxies of proxies of sportive ability throughout (i.e. playing the whole football game and self-declared skills), willingness to compete may also be a function of risk preferences, expected relative performance in the effort game, and actual skills. Our result holds to introducing these controls both separately and jointly – and the coefficients maintain relative constancy (see Appendix Table 2.A4).

2.7 Discussion and conclusion

We explore whether exposure to war-related violence affects the competitiveness of youth participating in a local street football tournament and a series of lab-in-field experiments in Sierra Leone. Previous economic literature on the consequences of civil war on preferences documents increases in-group cooperation, political activeness and altruism. The main contribution of this study is to provide insight into the determinants of competitive behavior and its relation with exposure to violent conflict. We bring new evidence that increased parochial altruism is a two-fold process—increasing in-group cooperation while exacerbating out-group antagonism.

Increased antagonism matters for post-conflict development as it shapes aggressiveness and, perhaps more saliently, competitiveness. To study war induced out-group dynamics we look both at aggressiveness

[18] The coefficient on exposure to war-related violence increases when observable controls are included. Following Bellows and Miguel (2009), this suggests that omitted bias is unlikely to explain away the effect (see also Altonji et al., 2005).

[19] The coefficient on the group interaction term is large and negative, as expected. This is suggestive of a substantial though not significant difference in coefficients across groups. As a further test, we allow for different residual variation across groups and compute Allison's delta (-0.570)–the effect of conflict exposure on competition can thus be interpreted as being 57% smaller towards the in-group than towards the out-group (Allison, 1999)

[20] Note that due to the small sample size measurement error inflates standard errors.

Table 2.6: Willingness to Compete

	(1) Out-group	(2) Out-group	(3) In-group	(4) In-group	(5) Pooled
Exposure to conflict	0.485**	0.510**	0.274	0.266	0.500**
	(0.222)	(0.244)	(0.227)	(0.270)	(0.227)
Ingroup (d)					0.154
					(0.202)
Exposure to conflict × in-group					-0.305
					(0.322)
Age		0.104		-0.228	-0.132
		(0.183)		(0.160)	(0.114)
Age squared		-0.00154		0.00538	0.00336
		(0.00416)		(0.00362)	(0.00258)
Education Level		0.171*		0.130	0.132**
		(0.0986)		(0.0834)	(0.0626)
Meals per day		-0.0178		-0.137	-0.0950
		(0.110)		(0.0975)	(0.0704)
Muslim (d)		0.305***		-0.0791	0.0384
		(0.118)		(0.150)	(0.104)
Mende (d)		-0.0835		0.0110	-0.0217
		(0.148)		(0.116)	(0.0889)
Played whole game (d)		0.405***		0.191*	0.204**
		(0.136)		(0.111)	(0.0847)
Self-declared skills		0.0206		-0.222	-0.0592
		(0.254)		(0.299)	(0.191)
Scored (d)		-0.267*		-0.125	-0.148
		(0.147)		(0.138)	(0.104)
Won the football game (d)		0.123		-0.0747	0.00454
		(0.135)		(0.114)	(0.0848)
Left footed (d)		-0.178		-0.213*	-0.204**
		(0.140)		(0.121)	(0.0908)
N	70	70	92	92	162
Pseudo R-Squared	0.055	0.207	0.011	0.106	0.105

Notes: robit marginal effects. Column 1 reports the univariate marginal effect of exposure to conflict on our experimental measure of willingness to compete towards the out-group (see Appendix I for variable definitions). Column 2 adds individual and football game related controls. Column 3 reports the univariate marginal effect of exposure to conflict on our experimental measure of willingness to compete towards the in-group. Column 4 adds individual and football game related controls. Column 5 reports the pooled marginal effect of exposure to conflict our experimental measure of willingness to compete, including individual and football game related controls, a group dummy, and an interaction term. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

during a football game and competitive behavior in laboratory experiment. We find that subjects more exposed to war violence during early childhood and preadolescence are not only robustly more likely to commit fouls during a football game, but are also more likely to self-select into a competition against an out-group in our experiment. Civil war does not only seem to foster cooperation towards perceived in-groups, but curbs distaste for free competition against perceived out-groups. Being more prone to cooperate and engage in public debates affects the community level provision of public goods, potentially promoting economic development (Bellows and Miguel, 2009). Similarly, accepting inequality-averse outcomes driven by a fair and regulated competition is a fundamental element of economic growth (Bartling et al., 2009).

Our findings are tentative; different types of conflicts could have varying legacies, and the human cost of conflict may never be justified by its "externalities" (Cassar et al., 2013). Yet, a growing body of evidence about war violence victims' profound changes in individual beliefs, values, and preferences poses new challenges to policy makers and post-conflict recovery strategists. It rejects the notion of conflict as "development in reverse" Collier et al. (2003). Not only has war historically promoted state formation and nation building – ultimately strengthening institutional capacity (Tilly and Ardant, 1975) – it may also be at the core of inclusive and dynamic societal transformations. Policy makers responsible for post-war recovery should be aware of the extent of these transformations and recognize heterogeneity among communities and individuals, not overlooking the significance of autonomous responses.

2.8 Appendix I: Variable Definitions

Exposure to Conflict. An individual victimization index resulting from the average response to these violence related questions: "during war time..." "did you ever witness combat, shooting and explosions?", "did you ever see a person injured because of war-related violence?" and "did you personally suffer from physical injury because of war-related violence?".

Parents Fought in War. Individual level dummy variable taking value of unity if any one of parents of respondent i have been active belligerents during the civil conflict, regardless of combatting sides. *Age.* Age of respondent i as measured in years, rounded down to the age at the last birthday.

Education Level. Individual level variable taking value 1 if the respondent was currently in primary school, 2 if the respondent was currently in junior secondary school, 3 if the respondent was currently in senior secondary school, 4 if respondent was enrolled or had completed tertiary education.

Mende (Fula, Mandingo, Temne) Tribe. Individual level dummy taking value of unity if the i-th respondent self-declared to be ethically Mende (Fula, Mandingo, Temne), zero if else.

Muslim Religion. Individual level dummy taking value of unity if the i-th respondent self-declared to be Muslim by religion, zero if else.

Meals per Day. Household level index representing the self-reported full meal consumtion patterns of respondent i's household.

Always in Kenema. Individual level dummy variable taking value of unity if the i-th respondent never left Kenema district over the course of the war.

Left Footed. Individual level dummy variable taking value of unity if the i-th respondent self-declared to be predominantly left-footed, zero if else.

Played Whole Game. Individual level dummy variable taking value of unity if the i-th respondent had respondent positively to the question "did you play the whole football game?", zero if else. The answer was crosschecked with the control questions "how many minutes did you play in this game" and "How many minutes did the game last in total?"; the dummy would take a value of zero if the ratio of their responses differed from unity.

Self-declared Skills. Individual level index constructed as the answer to the question "Compared to your team mates, how skillful would you say you are?"; on a scale of 1 (least skilled) to 5 (most skilled), standardized between 0 and 1.

Scored. Individual level dummy variable taking value of unity if the i-th respondent had scored at least one goal during the football game, zero if else.

Won the Football Game. Team level dummy variable taking value of 1 if the team of respondent i has won the football game, zero if else. Out of 14 games 1 ended up in a draw and the penalty kicks were

postponed to the next day due to insufficient light.

Foul Card in Football Game. Individual level dummy variable taking value of unity if the i-th respondent had received at least one yellow/red card up to that stage of the tournament.

Risk Propensity. Individual level variable based on the respondents' six choices in the risk game, spanning from zero (i.e. never gamble) to one (i.e. always gamble), and allowing for indifference by taking the last switch point as significant. The index is standardized.

Sharing in Dictator Game. The value donated in the relevant dictator game (standardized).

Expected Relative Performance. Individual level index constructed as the answer to the question "Compared to the rest of today's players, how well do you think you will perform in this game?"; on a scale of 0 (the worst) to 5 (the best), standardized between 0 and 1.

Balls on Target. The number of balls shot by the i-th subject in the effort game, successfully entering the basket (out of 10).

2.9 Appendix II: Sensitivity Analysis

Table 2.A1: Willingness to Compete (out-group)

	(1) 1-year age-group f.e.	(2) 2-year age-group f.e.	(3) 3-year age-group f.e.	(4) 4-year age-group f.e.
Exposure to conflict	0.693*	0.520**	0.524**	0.470**
	(0.367)	(0.239)	(0.230)	(0.233)
Education Level	0.383**	0.250**	0.223**	0.178*
	(0.153)	(0.0991)	(0.0916)	(0.0961)
Meals per day	-0.0176	0.0397	0.0179	-0.0111
	(0.156)	(0.110)	(0.115)	(0.110)
Muslim (d)	0.582***	0.408***	0.325***	0.323***
	(0.108)	(0.0929)	(0.116)	(0.118)
Mende (d)	0.00397	-0.0666	-0.121	-0.114
	(0.196)	(0.149)	(0.143)	(0.147)
Played whole game (d)	0.642***	0.445***	0.494***	0.431***
	(0.166)	(0.138)	(0.132)	(0.136)
Self-declared skills	-0.285	-0.00472	0.0568	0.0178
	(0.316)	(0.257)	(0.272)	(0.254)
Scored (d)	-0.502***	-0.302**	-0.370***	-0.250
	(0.102)	(0.123)	(0.102)	(0.152)
Won the football game (d)	0.307	0.167	0.0849	0.106
	(0.188)	(0.142)	(0.139)	(0.140)
Left footed (d)	-0.113	-0.0498	-0.125	-0.151
	(0.219)	(0.147)	(0.158)	(0.142)
N	56	65	69	69
R2	0.412	0.309	0.256	0.229

Notes: Probit marginal effects. Column 1 reports the marginal effect of exposure to conflict on our experimental measure of willingness to compete towards the out-group (see Appendix I for variable definitions), including individual and football game related controls, as well as 1-year age fixed effects. Column 2 replaces 1-year age fixed effects with 2-year age fixed effects. Column 3 replaces 2-year age fixed effects with 3-year age fixed effects. Column 4 replaces 3-year age fixed effects with 4-year age fixed effects. 14 observations dropped in (1), 5 observations dropped in (2) and 1 observation dropped in (3), due to quasi-separation issues related to small group fixed effects. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.A2: Willingness to Compete (out-group)

	(1) Outgroup: Always in Kenema	(2) Outgroup: Migrated	(3) Outgroup: All	(4) Pooled
Exposure to conflict	0.755	0.622	0.553**	0.621**
	(0.497)	(0.430)	(0.282)	(0.259)
Always in Kenema (d)			-0.350	-0.0550
			(0.325)	(0.207)
Exposure to conflict x Always in Kenema			0.214	-0.217
			(0.506)	(0.327)
Ingroup (d)				0.139
				(0.197)
Exposure to conflict × in-group				-0.278
				(0.314)
Age	-0.263	1.217**	-0.00285	-0.135
	(0.303)	(0.491)	(0.210)	(0.119)
Age squared	0.00686	-0.0277**	0.000747	0.00335
	(0.00754)	(0.0111)	(0.00474)	(0.00269)
Education Level	0.181	0.0646	0.167	0.138**
	(0.116)	(0.185)	(0.103)	(0.0633)
Meals per day	-0.0832	0.0506	-0.0539	-0.0730
	(0.135)	(0.243)	(0.126)	(0.0732)
Muslim (d)	0.276**	-0.0751	0.286**	0.0105
	(0.120)	(0.248)	(0.122)	(0.103)
Mende (d)	-0.179	-0.109	-0.157	-0.0324
	(0.226)	(0.271)	(0.153)	(0.0900)
Played whole game (d)	0.212	0.602***	0.395***	0.220**
	(0.173)	(0.191)	(0.143)	(0.0857)
Self-declared skills	-0.0845	-0.00360	-0.0436	-0.0690
	(0.347)	(0.406)	(0.263)	(0.193)
Scored (d)	-0.134	-0.409	-0.277*	-0.136
	(0.183)	(0.454)	(0.155)	(0.110)
Won the football game (d)	0.0281	0.391*	0.161	0.0139
	(0.169)	(0.222)	(0.142)	(0.0860)
Left footed (d)	-0.250**	-0.159	-0.184	-0.219**
	(0.112)	(0.400)	(0.142)	(0.0875)
N	36	34	70	162
R2	0.30	0.33	0.23	0.13

Notes: Probit marginal effects. Column 1 reports the marginal effect of exposure to conflict on our experimental measure of willingness to compete towards the out-group (see Appendix I for variable definitions), including individual and football game related controls, for the subsample of respondents who were born and had never moved out of Kenema district. Column 2 presents the outcomes for the remaining subsample, born elsewhere or temporarily out-migrated from Kenema district during the conflict. Column 3 reports the marginal effect of exposure to conflict on our experimental measure of willingness to compete towards the out-group, including individual and football game related controls, and a variable capturing the absence of temporary out-migration. Column 4 presents the outcome for the pooled sample (in-group and out-group). Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.A3: Willingness to Compete (out-group)

	(1) Exposure + Displacement	(2) Football Match Fixed Effects	(3) Team Fixed Effects	(4) Team Clustered SE
Exposure to conflict	0.687**	0.574**	0.628**	0.510**
	(0.269)	(0.255)	(0.281)	(0.239)
Age	0.092	0.156	0.060	0.104
	(0.180)	(0.183)	(0.216)	(0.187)
Age squared	-0.001	-0.003	-0.001	-0.002
	(0.004)	(0.004)	(0.005)	(0.004)
Education Level	0.156	0.139	0.159	0.171**
	(0.098)	(0.098)	(0.101)	(0.077)
Meals per day	-0.038	0.046	-0.019	-0.018
	(0.108)	(0.120)	(0.161)	(0.107)
Muslim (d)	0.290***	0.359***	0.332**	0.305**
	(0.111)	(0.131)	(0.156)	(0.148)
Mende (d)	-0.122	-0.064	-0.185	-0.084
	(0.149)	(0.176)	(0.201)	(0.150)
Played whole game (d)	0.383***	0.342**	0.447**	0.405***
	(0.135)	(0.153)	(0.174)	(0.074)
Self-declared skills	0.044	-0.012	-0.152	0.021
	(0.252)	(0.259)	(0.292)	(0.259)
Scored (d)	-0.274**	-0.189	-0.112	-0.267**
	(0.133)	(0.185)	(0.244)	(0.127)
Won the football game (d)	0.157	0.062		0.123
	(0.139)	(0.152)		(0.108)
Left footed (d)	-0.190	-0.186	-0.228*	-0.178**
	(0.126)	(0.149)	(0.136)	(0.078)
N	70	70	63	70
R2	0.218	0.258	0.253	0.207

Notes: Probit marginal effects. Column 1 reports the marginal effect of exposure to conflict on our experimental measure of willingness to compete towards the out-group (see Appendix I for variable definitions), including individual and football game related controls, were the exposure to conflict includes a dummy for forced displacement as additional measure of victimization. Column 2 includes football match fixed effects. Column 3 includes team fixed effects. Column 4 clusters standard errors at the team level. 7 Observations dropped in (3) due to quasi-separation issues related to small group fixed effects. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.A4: Willingness to Compete (out-group)

	(1) Risk Preferences	(2) Expected Relative Performance	(3) Actual Performance	(4) Risk, Expected, and Actual Performance
Exposure to conflict	0.516**	0.535**	0.470*	0.495*
	(0.243)	(0.250)	(0.253)	(0.256)
Risk Preferences	0.0262			0.0179
	(0.0723)			(0.0715)
Expected performance		0.489		0.467
		(0.580)		(0.591)
Balls on target			-0.0230	-0.0233
			(0.0386)	(0.0396)
Age	0.0992	0.0872	0.0889	0.0699
	(0.185)	(0.186)	(0.183)	(0.188)
Age squared	-0.00145	-0.00126	-0.00117	-0.000842
	(0.00420)	(0.00421)	(0.00417)	(0.00427)
Education Level	0.172*	0.159	0.180*	0.169
	(0.0988)	(0.101)	(0.101)	(0.104)
Meals per day	-0.0191	-0.0299	-0.0198	-0.0318
	(0.111)	(0.109)	(0.110)	(0.111)
Muslim (d)	0.306**	0.311***	0.315***	0.320***
	(0.119)	(0.118)	(0.117)	(0.117)
Mende (d)	-0.0966	-0.0740	-0.0828	-0.0821
	(0.147)	(0.152)	(0.149)	(0.150)
Played whole game (d)	0.403***	0.373**	0.429***	0.397***
	(0.138)	(0.146)	(0.140)	(0.151)
Self-declared skills	0.0257	-0.0621	0.0430	-0.0318
	(0.256)	(0.275)	(0.261)	(0.283)
Scored (d)	-0.268*	-0.253	-0.288**	-0.277*
	(0.148)	(0.155)	(0.141)	(0.146)
Won the football game (d)	0.131	0.114	0.146	0.143
	(0.137)	(0.134)	(0.141)	(0.143)
Left footed (d)	-0.187	-0.156	-0.212	-0.199
	(0.140)	(0.150)	(0.143)	(0.150)
N	70	70	70	70
R2	0.209	0.215	0.211	0.219

Notes: Probit marginal effects. Column 1 reports the marginal effect of exposure to conflict on our experimental measure of willingness to compete towards the out-group (see Appendix I for variable definitions), including individual and football game related controls, and our experimental measure of risk preferences. Column 2 includes expected relative performance, standardized between 0 (the worst) and 1 (the best). Column 3 includes actual performance in terms of the number of balls on target (standardized). Column 4 includes all three measures risk preferences, performance expectation, and skills. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

2.10 Bibliography

Adhvaryu, A. and J. Fenske (2013). War resilience and political engagement in Africa.

Allison, P. D. (1999). Comparing logit and probit coefficients across groups. *Sociological Methods and Research 28*(2), 186–208.

Altonji, J. G., T. E. Elder, C. E. Taber, G. Cain, T. Conley, T. Deleire, and S. D. Levitt (2005). Selection on observed and unoserved variables: Assessing the effectiveness of catholic schools. *Journal of Political Economy 113*(1), 151–184.

Bartling, B., E. Fehr, M. Maréchal, and D. Schunk (2009). Egalitarianism and competitiveness. *The American Economic Review 99*(2), 93–98.

Bartling, B., E. Fehr, and D. Schunk (2012, jun). Health effects on children's willingness to compete. *Experimental Economics 15*(1), 58–70.

Bauer, M., A. Cassar, J. Chytilová, and J. Henrich (2014, jan). War's Enduring Effects on the Development of Egalitarian Motivations and In-Group Biases. *Psychological science 25*(1), 47–57.

Bellows, J. and E. Miguel (2009). War and local collective action in Sierra Leone. *Journal of Public Economics 93*(11-12), 1144–1157.

Benenson, J. F., J. Pascoe, and N. Radmore (2007, may). Children's altruistic behavior in the dictator game. *Evolution and Human Behavior 28*(3), 168–175.

Bernhard, H., U. Fischbacher, and E. Fehr (2006, aug). Parochial altruism in humans. *Nature 442*(7105), 912–5.

Blattman, C. (2009). From Violence to Voting: War and political participation in Uganda. *American Political Science Review 103*(2), 231–247.

Blattman, C. and E. Miguel (2010). Civil War. *Journal of Economic Literature 48*(1), 3–57.

Bowles, S. (2006, dec). Group competition, reproductive leveling, and the evolution of human altruism. *Science 314*(5805), 1569–1572.

Bruijne, K. D. (2014). Introducing the Sierra Leone Local - Location Event Dataset. Technical report, Armed Conflict Location Event Dataset.

Cassar, A., P. Grosjean, and S. Whitt (2013). Legacies of Violence: Trust and Market Development. *Journal of Economic Growth 18*(3), 285–318.

Chamarbagwala, R. and H. E. Morán (2011). The Human Capital Consequences of Civil War: Evidence from Guatemala. *Journal of Development Economics 94*(1), 41–61.

Choi, J.-K. and S. Bowles (2007, oct). The coevolution of parochial altruism and war. *Science 318*(5850), 636–640.

Collier, P., V. L. Elliott, H. Hegre, A. Hoeffler, M. Reynal-Querol, and N. Sambanis (2003). *Breaking the Conflict Trap: Civil War and Development Policy*. Washington D.C.: World Bank.

Conibere, R., J. Asher, K. Cibelli, J. Dudukovich, R. Kaplan, and P. Ball (2004). Statistical Appendix to the Report of the Truth and Reconciliation Commission of Sierra Leone. Technical Report October, The Benetech Initiative, Palo Alto.

Denny, K. and V. O'Sullivan (2007). The Economic Consequences of Being Left-Handed: Some Sinister Results. *Journal of Human Resources 42*(2), 353–374.

Doucet, D. and M. Denov (2012, aug). The power of sweet words: Local forms of intervention with war-affected women in rural Sierra Leone. *International Social Work 55*(5), 612–628.

Duggan, M. and S. D. Levitt (2002). Winning isn't everything: Corruption in sumo wrestling. *American Economic Review 92*(5), 1594–1605.

Dyregrov, A., R. Gjestad, and M. Raundalen (2002). Children exposed to warfare: a longitudinal study. *Journal of Traumatic Stress 15*(1), 59–68.

Elias, L. J., M. P. Bryden, and M. B. Bulman-Fleming (1998). Footedness is a better predictor than is handedness of emotional lateralization. *Neuropsychologia 36*(1), 37–43.

Eriksson, T., S. Teyssier, and M.-C. Villeval (2009, jul). Self-Selection and the Efficiency of Tournaments. *Economic Inquiry 47*(3), 530–548.

Faurie, C., N. Vianey-Liaud, and M. Raymond (2006, jan). Do left-handed children have advantages regarding school performance and leadership skills? *Laterality: Asymmetries of Body, Brain and Cognition 11*(1), 57–70.

Fehr, E., H. Bernhard, and B. Rockenbach (2008, aug). Egalitarianism in young children. *Nature 454*(7208), 1079–83.

Garicano, L. and I. Palacios-Huerta (2006). Sabotage in Tournaments: Making the Beautiful Game a Bit Less Beautiful.

Gates, S., H. Hegre, H. M. Nygård, and H. Strand (2012). Development Consequences of Armed Conflict. *World Development 40*(9), 1713–1722.

Ghobarah, H., P. Huth, and B. Russett (2003). Civil Wars Kill and Maim People – Long after the Shooting stops. *American Political Science Review 97*(2), 189–202.

Gilligan, M. J., B. J. Pasquale, and C. Samii (2014). Civil War and Social Cohesion: Lab-in-the-Field Evidence from Nepal. *American Journal of Political Science 58*(3), 604–619.

Gneezy, U., K. L. Leonard, and J. A. List (2009). Gender Differences in Competition: Evidence\\ From a Matrilineal and a Patriarchal Society. *Econometrica 77*(5), 1637–1664.

Goldberg, E., R. Harner, M. Lovell, K. Podell, and S. Riggio (1994). Cognitive Bias, Functional Cortical Geometry, and the Frontal Lobes: Laterality, Sex, and Handedness. *Journal of Cognitive Neuroscience 6*(3), 276–296.

Harbaugh, W., K. Krause, and L. Vesterlund (2002). Risk attitudes of children and adults: Choices over small and large probability gains and losses. *Experimental Economics 84*(1), 53–84.

Harbring, C. and B. Irlenbusch (2003, aug). An experimental study on tournament design. *Labour Economics 10*(4), 443–464.

Hoffman, M. and U. Gneezy (2010). Left Handed Women are More Competitive than Right Handed Men : On the Biological Basis of Gender Differences in Competitiveness.

Human Rights Watch (1999). Sierra Leone: Getting Away with Murder, Mutilation, and Rape. Technical report, New York.

Humphreys, M. and J. M. Weinstein (2006). Handling and Manhandling Civilians in Civil War. *The American Political Science Review 100*(3), 429–447.

Iqbal, Z. (2006). Health and human security: The public health impact of violent conflict. *International Studies Quarterly 50*(3), 631–649.

Iqbal, Z. and C. Zorn (2010). Violent Conflict and the Spread of HIV/AIDS in Africa. *The Journal of Politics 72*(1), 149–162.

Kalyvas, S. N. (2006). *The Logic of Violence and Civil War*. New York: Cambridge University Press.

Keen, D. (2005). *Conflict & Collusion in Sierra Leone*. Oxford: James Currey.

Lai, B. and C. Thyne (2007, may). The Effect of Civil War on Education, 1980–97. *Journal of Peace Research 44*(3), 277–292.

Layne, C. M., J. A. Olsen, A. Baker, J. P. Legerski, B. Isakson, A. Pasalić, E. Duraković-Belko, N. Dapo, N. Campara, B. Arslanagić, W. R. Saltzman, and R. S. Pynoos (2010). Unpacking trauma exposure risk factors and differential pathways of influence: predicting postwar mental distress in Bosnian adolescents. *Child Development 81*(4), 1053–1076.

Leibbrandt, A., U. Gneezy, and J. A. List (2013). Rise and fall of competitiveness in individualistic and collectivistic societies. *Proceedings of the National Academy of Sciences of the United States of America 110*(23), 9305–9308.

Macksoud, M. S. and J. L. Aber (1996). The war experiences and psychosocial development of children in Lebanon. *Child Development 67*(1), 70–88.

Miguel, E., S. M. Saiegh, and S. Satyanath (2011, mar). Civil War Exposure and Violence. *Economics & Politics 23*(1), 59–73.

Niederle, M. and L. Vesterlund (2007). Do women shy away from competition? Do men compete too much? *The Quarterly Journal of Economics 122*(3), 1067–1101.

Norwegian Refugee Council (2003). Profile of Internal Displacement: Sierra Leone. Technical report, Norwegian Refugee Council, Geneva.

Peters, K. (2011). *War and the Crisis of Youth in Sierra Leone*. Cambridge: Cambridge University Press.

Peters, M. and B. M. Durding (1979). Footedness of Left- and Right-Handers. *The American Journal of Psychology 92*(1), 133–142.

Powell, S. and R. Rosner (2003, jan). Posttraumatic growth after war: A study with former refugees and displaced people in Sarajevo. *Journal of clinical psychology 59*(1), 71–83.

Richards, P. (1999). New political violence in Africa: Secular Sectarianism in Sierra Leone. *GeoJournal 47*, 433–442.

Rohner, D., M. Thoenig, and F. Zilibotti (2013). Seeds of distrust: Conflict in Uganda. *Journal of Economic Growth 18*(3), 217–252.

Roth, A. E. and I. Erev (1995). Learning in extensive-form games: Experimental data and simple dynamic models in the intermediate term. *Games and Economic Behavior 8*(1), 164–212.

Sanders, B., J. R. Wilson, and S. G. Vandenberg (1982, apr). Handedness and Spatial Ability. *Cortex 18*(1), 79–89.

Smith, L. A., C. Gambette, and T. Longly (2004). Conflict Mapping in Sierra Leone : Violations of International Humanitarian Law from 1991 to 2002. Technical Report March, No Peace Without Justice.

Smith, P., S. Perrin, and W. Yule (2002). War exposure among children from Bosnia-Hercegovina: psychological adjustment in a community sample. *Journal of Traumatic Stress 15*(2), 147–156.

Staub, E. and J. Vollhardt (2008, jul). Altruism born of suffering: the roots of caring and helping after victimization and other trauma. *The American journal of orthopsychiatry 78*(3), 267–280.

Sutter, M. (2007, jan). Outcomes versus intentions: On the nature of fair behavior and its development with age. *Journal of Economic Psychology 28*(1), 69–78.

Tedeschi, R. and L. Calhoun (1996). The Posttraumatic Growth Inventory: Measuring the positive legacy of trauma. *Journal of traumatic stress 9*(3), 455–471.

Themnér, L. and P. Wallensteen (2014). Armed conflicts, 1946-2013. *Journal of Peace Research 51*(4), 541–554.

Tilly, C. and G. Ardant (1975). *The Formation of national States in Western Europe*. Princeton, N.J.: Princeton University Press.

Van Dijk, F., J. Sonnemans, and F. V. Winden (2001). Incentive systems in a real effort experiment. *European Economic Review 45*(2), 187–214.

Vollhardt, J. (2009, feb). Altruism born of suffering and prosocial behavior following adverse life events: A review and conceptualization. *Social Justice Research 22*(1), 53–97.

Voors, M. J., E. E. M. Nillesen, P. Verwimp, E. H. Bulte, R. Lensink, and D. P. V. Soest (2012). Violent Conflict and Behavior: A Field Experiment in Burundi. *American Economic Review 102*(452), 941–964.

Weinstein, M. D., M. D. Smith, and D. L. Wiesenthal (1995, dec). Masculinity and hockey violence. *Sex Roles 33*(11-12), 831–847.

Chapter 3

Input Subsidies to Increase Food Security

Abstract

We use a field experiment to test the impact of a one-off input subsidy program for a sample of smallholders in Eastern DRC. To date, studies on the topic are typically concentrated in areas where use of the subsidized input is common, which raises the question whether results are generalizable to settings where input use is very limited, yet adoption may be warranted. We investigate the impact of input subsidies in Eastern DRC, arguably among the poorest and unstable regions of the world, where farmers face daily threats of (extreme) violence and displacement, and prior use of fertilizer or other advanced agricultural technologies has been exceptionally low. We find robust evidence for impacts on input use at the extensive margin, one year after the subsidy program: providing subsidies increases fertilizer use by five percentage points, while use of inoculant increases by three percentage points. These effects are substantial given very low use rates in villages without the subsidy program. We measure impacts two agricultural seasons after the subsidy program, suggesting effects persist beyond the season in which the subsidized inputs were offered. Higher input use however does not translate into higher yields in our sample, nor does it affect food security. Moreover, input use was not affected in villages further away from input markets, suggesting that time and costs associated with accessing inputs restrict the impact of subsidy interventions in a context like Eastern DRC.

This chapter is based on: Koen Leuveld, Eleonora Nillesen, Janneke Pieters, Martha Ross, Maarten Voors and Soazic Elise Wang Sonne. *Agricultural extension and input subsidies to reduce food insecurity. Evidence from a field experiment in the Congo.* (Working Paper)

3.1 Introduction

Smallholder farmers in sub-Saharan Africa face acute constraints to productivity. Output prices are low, input costs are high, and credit markets function poorly, resulting in low adoption rates of new technologies (Morris et al., 2007; Sheahan and Barrett, 2014). Input subsidization programs have recently been reintroduced to address constraints of high input prices, and hence lower cost of experimentation, ultimately opening input markets to farmers previously excluded, thereby putting farmers on a track of increased productivity and food security (Denning et al., 2009; Dorward et al., 2004). Despite its apparent appeal there is little rigorous evidence of input subsidies affecting technology uptake, persistent use, agricultural production and ultimately, farmers' incomes (but see Carter et al., 2014, 2019, for recent work on this topic in Mozambique). Moreover, existing studies focus on a single specific input (fertilizer) provided through large-scale government-funded programs (so-called ISPs) in contexts where private input markets already exist, and where fertilizer use is common and provides high returns. An exclusive focus on these environments is unlikely to provide a representative picture of the returns to fertilizer and farmers' demand for it at commercial prices (also see Jayne et al., 2018). We therefore extend the small evidence base on the impacts of a one-off subsidy program, using a randomized field experiment in a setting where fertilizer and other input use is uncommon, private agro-dealers for such inputs are sparse, and levels of food insecurity are exorbitantly high. Our study complements previous rigorous analyses on the topic of input subsidies in at least two ways. First, our input subsidy program targets subsistence farmers in a fragile and conflict-affected environment, with a clear need for advanced inputs and technologies, to ameliorate pressing concerns of low agricultural output and food insecurity. Second, we look at the impact on use of both fertilizer and inoculant. Inoculant is a commercially available product where grain legumes are coated (inoculated) with bacteria that fix nitrogen gas from the air into a form usable by plants, contributing to high-protein legumes, higher yields and better soil fertility (Woomer et al., 2014). While fertilizer and its potential benefits are typically known to most farmers, inoculant is not, and plausibly new to all households in our sample. The subsidy scheme was implemented in conjunction with a large-scale agronomic program, N2Africa, which aims to improve welfare and food security through an extensive agricultural extension program (Woomer et al., 2014). Here we evaluate the impact of a subsidy scheme implemented after the extension services, which took place before the research team was fully engaged and prior to the baseline data collection. We are hence unable to include the impact of extension services in our evaluation but will refer to these services in this paper where deemed necessary. Our main research objective is thus to assess whether input subsidies increase smallholder inputs use, and as such affect productivity and, ultimately, food security.

Our sample villages are villages that all received training by an agricultural extension worker from

local agronomic NGOs, one season prior to the introduction of the subsidy scheme. At the end of the training, households in a random half of the sampled extension villages were offered the opportunity to buy subsidized input packages to be used in the next main growing season. The input packages included a combination of inorganic fertilizer, improved seeds, and inoculant at a subsidized price, which was 75% of the market price at that time.

We estimate intent-to-treat (ITT) effects on outcomes two agricultural seasons (roughly one year) after the subsidies were provided. This allows us to assess medium-term impacts in a period in which no subsidies were given. We find the subsidy scheme had a positive impact on the use of fertilizer and inoculant. ITT estimates show that inoculant use increased by almost three percentage points, and fertilizer use by more than five percentage points in villages receiving the input subsidy, compared to the control villages. These effects are substantial given the low proportion of users of inoculant (1 percent) and fertilizer (3 percent) in the control group, and given the time between the intervention and the outcomes. Despite increased input use, however, we find no evidence that input subsidies increased yields or improved food security. For our yield variable this is possibly due to reduced statistical power from the relatively low number of observations for our beans and cassava yields measure. Another, alternative explanation is that input use did not increase enough to generate measurable average yield impacts. And, if indeed the intervention did not generate any impacts on yield, one may also arguably expect no discernable impacts on food security indicators.

We assess impact heterogeneity with respect to variables that serve as obvious moderators for the subsidy scheme to be effective: distance to markets, land ownership, gender and education level of the household head, and village size (see e.g. Jacoby, 2000; Fenske, 2011; Ali, 2011; Magnan et al., 2015). Program impacts are not affected by land ownership, village size, gender and educational level of the household head, but do vary with distance to input markets. We find that the average positive effect of the program on input use is almost completely offset by the negative interaction for villages more than 5 km (the median distance) from input markets, indicating that there was no effect of the program on input use in these villages. All in all this suggests structural constraints in access to particular input markets hinder further development in the agricultural sector.

The outline of the paper is as follows. Section 2 explores existing literature on constraints to agricultural technology adoption and reviews the evidence on the impact of targeted interventions related to input subsidies. In section 3 we describe the agricultural context of eastern DRC and the intervention design. In section 4 we discuss the data. In section 5 we discuss our empirical strategy to identify the impacts of the treatment on input use, yields, and food security. Section 6 presents the results, including heterogeneous impacts and robustness checks. Section 7 concludes.

3.2 Constraints to technology adoption

Despite abundant evidence of positive yield impacts at experimental trial stations, households in many Sub-Sahara African countries show (very) low adoption rates of new agricultural technologies. The literature on adoption decisions offers explanations ranging from barriers to information, credit and supply, to differences in agro-ecological suitability, (time-inconsistent) preferences, risk and ambiguity aversion, or heterogeneous returns to adoption (Duflo et al., 2011; Suri, 2011; Dercon and Christiaensen, 2011; Ross et al., 2012; Barham et al., 2014). While agricultural technology adoption may encompass anything from (i) new inputs like fertilizer and improved seeds, to (ii) modern land use practices and (iii) machinery, studies on smallholder farms typically focus on mitigating barriers for (i) and (or) (ii). Fertilizer use and improved seeds are strongly associated with increased levels of agricultural yields and productivity and providing such inputs at below market prices was long seen as a key element to propel farm households onto a sustained path of economic development and increased levels of food security. This view changed in the 1990s as studies failed to find strong effects of such programs contributing to agricultural productivity and combating poverty. Indeed, input subsidy programs were increasingly associated with being politicized, negative externalities, taking up a large share of a developing country government's budget and prohibiting the development of private markets for these type of goods (World Bank, 2000; Pan and Christiaensen, 2012; Jayne et al., 2018). Yet, input subsidy programs have witnessed a revival in recent years, with new programs placing greater emphasis on better targeting, improved linkages with markets, and better facilitation of commercial sales (e.g Morris et al., 2007; World Bank, 2000). The new generation of input subsidy programs therefore entails more than providing subsidy alone but often also addresses information-, credit-, and supply-side constraints.

There is however little consensus or rigorous assessment of the longer-term success of these programs (see Morris et al., 2007; Druilhe and Barreiro-hurlé, 2012; Jayne and Rashid, 2013; Jayne et al., 2018, for recent syntheses on the evidence) with a few exceptions. Ricker-Gilbert and Jayne (2017) investigate the persistence of fertilizer use and crowding in/crowding out demand effects for commercial fertilizer among Malawi farmers. Using panel estimators, they find limited evidence of enduring effects of fertilizer subsidies and maize production. A recent experimental study by Carter et al. (2014), also report positive impacts of vouchers for fertilizer and improved seeds that are consistent with a social learning model of adoption among rural households in Mozambique. They find an increased use of fertilizer for households with a higher proportion of social network members receiving the voucher. Using the same data, Carter et al. (2019) also investigate persistence of fertilizer use after the subsidy period and spillovers to social networks of subsidy recipients. They report impacts persisting across non-subsidized seasons, and the existence of spillovers, also within the treatment group, as treatment farmers may have helped each other

learn how to use new inputs.

These studies all consider large-scale government initiatives executed in areas where input use is common, and returns are high. This raises the question whether findings can be extrapolated to a conflict-prone setting where commercial inputs are still relatively new and the government alongside NGOs has only recently started to introduce them to farmers. Our study provides the start of an answer to this question by estimating the causal, medium-term impact, of subsidized inputs (fertilizer and inoculant) offered in a fragile and complex environment where farmers are constrained beyond the geophysical, information, and (credit) market access challenges that are typically considered.

3.3 Context and intervention design

Our study is set in eastern DRC, a region with severe infrastructural and market under-development. Farmers face numerous challenges in crop production including protracted violent conflict, extreme poverty and unfavorable climatic conditions (Vlassenroot and Raeymaekers, 2004; Ansoms and Marivoet, 2009). With more than 70 percent of the population primarily involved in the agricultural sector, the majority being rural smallholder producers, agriculture is an impactful sector to target for development and fighting hunger and poverty. The area demonstrates high potential for sustainable agricultural growth, but as a result of recurring violence and high population displacement, agricultural development initiatives have been severely obstructed (Vlassenroot and Raeymaekers, 2004).[1] Currently, the region ranks amongst the highest in the world for food insecurity and malnutrition rates and is classified as a low-income food-deficit country (LIFDC) (Lambrecht et al., 2016; Vanlauwe et al., 2019; WFP, 2014; UNDP, 2015). Recognizing the need to strengthen agricultural sector performance, the DRC government has identified increased agricultural productivity and connecting farmers to markets as key priorities in their Poverty Reduction Strategy Paper (PRSP) and National Agricultural Investment Plan 2013-2020. N2Africa is an ambitious multi-country program tackling these challenges. Our study takes place within the context of the N2Africa program, which kicked off in 2009 in eight Sub-Sahara African countries. Below we briefly discuss the N2Africa program to provide the relevant backdrop against which our subsidy intervention and evaluation took place. As stated in the introduction, the subsidy scheme is a standalone intervention implemented within N2Africa villages.

[1] Conflict-ridden environments like DRC are characterized by distorted in-and output markets, credit constraints, limited access to information, and changes in social networks, social cohesion, and risk preferences (e.g. González and Lopez, 2007; Voors et al., 2012; Gilligan et al., 2014). These factors are in turn associated with people's propensity to invest in new(er) technologies, inputs or crops.

3.3.1 Background to N2Africa

N2Africa's primary objectives are to improve agricultural yields, food security, and incomes by increasing soil fertility. The most important manner in which this is done is through the inoculation of legumes with the Rhizobia bacteria, which fix atmospheric nitrogen in the soil, removing the need for Nitrogen fertilizer (Wagner, 2012; Mulongoy, 1992). N2Africa specifically targets smallholder farmers in sub-Saharan Africa, as nitrogen depleted soils are ubiquitous across sub-Saharan Africa, and are a key contributor to low agricultural yields among rural subsistence producers. Biological Nitrogen Fixation is considered to have great potential in increasing agricultural intensification by sustainably improving soil fertility, thus increasing yields (Peoples et al., 1995).[2]

Our study area lies in the South-Kivu province in eastern DRC, where an international consortium manages the N2Africa program. The research area stretches along three axes within the South-Kivu province. The Northern Axis stretches north from the provincial capital of Bukavu following the shore of Lake Kivu, at an altitude of some 1500m. The Western Axis is located in the highlands to the west of Bukavu. The Southern axis comprises the Ruzizi plain to the south of Bukavu, at an altitude of 600m. Soil type, rainfall, temperatures, sunlight, and land use vary substantially across the three axes, necessitating careful tailoring of agricultural interventions to fit local agro-climatic needs.

In South-Kivu, N2Africa formed partnerships with six locally operating NGOs, each of which had prior experience with agricultural development initiatives undertaken within the designated project zone. In January 2013, at the start of the secondary growing season, (so-called season B) N2Africa commenced a training intervention.[3] Extension workers established experimental trials at the project's South Kivu headquarters (close to Bukavu), which consisted primarily of the intercropping of soybean with either cassava or maize using best agronomic practices related to plant spacing and appropriate inoculant and fertilizer application. Participating communities, in conjunction with extension workers, selected 'lead' farmers from eligible individuals who were able to read and write, owned land, and had extensive experience in farming. Lead farmers were brought to visit the experimental trials and to select the improved inputs and processes they expected to be most successful given local constraints and conditions.

These lead farmers subsequently worked in a group of 15-30 other farmers within their community and received legume technology sample packages that included a small amount of inputs for a legume of choice (seed, fertilizer, inoculant, adhesive, etc.) in addition to training on new management practices on plant spacing, inoculant use, and intercrop management. They also received information about the nutritional benefits of legume consumption, and training on value-added processing of legumes to generate

[2]Careful agronomic trials, discussed in Vanlauwe et al. (2019), suggest modest increases in yields. There is no indication that the variance in yields would change, implying a risk neutral technology.

[3]This region has two growing seasons. The primary growing season (referred as growing season A) runs from July till November, while the secondary season B runs from January till the end of May.

income opportunities. Lead farmers set up local demonstration plots, where co-villagers could observe the application of new inputs and different management techniques (compared against a control plot where traditional methods were practiced). Newly gained knowledge about legume processing and nutritional information was also shared with the group members. Interested group members could ask to receive small input sample packages with which to experiment on their own fields. Extension workers regularly visited the communities during the growing season B in 2013 to assess results, listen to farmers' experiences and provide advice. Qualitative evidence collected by one of the research team members and colleagues reports the general success of demonstration trials as part of the extension services (see Kendzior et al., 2015). Farmers reported better knowledge about new farming techniques and processing of produce, and observed how the use of inoculant led to earlier germination and bigger pods in soybean production, though the underlying biological explanation as to how inoculant exactly worked was not explained by the NGO workers. Note that all activities that took place in season B of 2013 were not part of the evaluation and occurred prior to our baseline data collection. The next subsection describes the input subsidy scheme.

3.3.2 Input subsidy program

Half of the villages in our sample were randomly selected to receive an offer to buy a package of subsidized inputs for use in the following primary growing season A of 2013 (the primary growing season runs from the beginning of July till the end of November). Figure 3.1 depicts the timeline of the subsidy intervention and research activities. Note that all of the villages in our sample received the same N2Africa extension services that we described above, prior to the random assignment of the subsidy treatment. An obvious drawback of this design is that we cannot test the combined effect of extension services and subsidies versus subsidies alone, nor whether extension services become (more) effective once subsidies are also provided.[4]

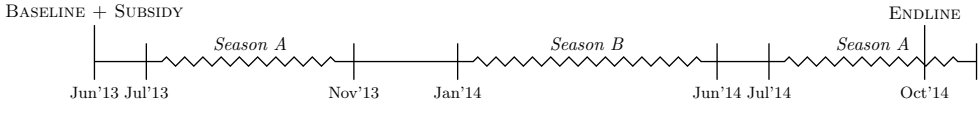


Figure 3.1: Study timeline

To ensure that the NGOs' relationships of mutual trust with communities were effectively leveraged, implementing partners for the input subsidy program were assigned to the villages in which they also had

[4]We are well aware of the trade-off we had to make here. Ideally we would have had four treatment arms – N2Africa extension only, N2Africa extension plus subsidy, subsidy only and a control group, The N2Africa program is however based on the premise of providing extension services combined with new inputs and improved technologies, hence providing subsidies alone would not naturally fit their approach. Also, South-Kivu provides an extremely challenging working environment due to high levels of insecurity. After long consultations with our local partners we therefore concluded that a more complicated intervention design that above all did not align with N2Africa's standard programme was unwarranted.

implemented the N2Africa extension services during the previous season. Local development committees (CLD) informed community members of the possibility to buy new inputs at a reduced price (75% of the market price) and provided a delayed payback scheme, in which a deposit of 500 FC (0.54 USD) was required upfront and the remainder was owed after the next harvest. Participants were also offered the option to pay back in kind (seeds) instead of cash if preferred. Each implementing partner NGO customized six variations of input packages (each worth about 26 USD) that all contained a combination of improved seeds, fertilizer and (or) inoculant to best suit the preferences and needs of the local farmers. The value of the input packages of 26 USD is a significant amount compared to our estimate of the average household's value of agricultural production (180 USD) for one season. The down payment on the other hand is very affordable to the average farmer. CLDs were responsible for registering community farmers and ordering the necessary packages. Agro-dealers delivered the ordered inputs to the communities before the start of the new 2013 planting season A, a month later. Inputs were delivered to the CLDs, who were then responsible for coordinating the distribution of the inputs to the respective buyers within the community and collecting the remaining payment owed after the harvest.

3.4 Data

Our research comprises 64 villages. The sampling frame was developed in collaboration with the implementing partners and required villages selected satisfy (i) that at least one of the implementing partners had established contacts within the community; (ii) that the village was accessible by motorized transport; and (iii) that the village had not participated in any N2Africa intervention previously, other than the extension program in the previous season.

Villages were randomly assigned to receiving the subsidy scheme or not, stratified within each axis. Data collection involved several steps (see Figure 3.1). First, during June and July 2013, we administered a detailed household survey to 10 randomly selected households per village, comprising a sample of 521 households.[5] In each household, the person most knowledgeable about agricultural activities was the primary respondent. In almost all cases (93%) this was the head of household (56%) or their spouse (37%). In the remaining cases, other adult household members responded. In addition to the household interviews, community meetings were organized to collect information on proximity to markets and demographics. A year and a half later, in October 2014, we implemented a second round of surveys with the same households. The questionnaires included modules on demographics, housing, agriculture, food security, and social and formal financial support systems. A team of 37 enumerators, recruited with the assistance of the Catholic University of Bukavu (UCB), conducted the surveys and community meetings.

[5]Interviews were conducted primarily in Swahili and data was recorded using ODK software on tablets.

Table 3.1: Baseline descriptive statistics and balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All		Treatment		Control		(4)-(6)
	N	Mean	N	Mean	N	Mean	
Inoculant knowledge	521	0.05	256	0.05	265	0.05	0.01
		(0.22)		(0.23)		(0.22)	
Fertilizer knowledge	521	0.94	256	0.93	265	0.95	-0.02
		(0.24)		(0.26)		(0.22)	
Inoculant Use	521	0.03	256	0.04	265	0.03	0.01
		(0.18)		(0.19)		(0.16)	
Fertilizer Use	521	0.03	256	0.03	265	0.03	0.00
		(0.17)		(0.17)		(0.16)	
Beans Yield	255	3.55	135	3.47	120	3.63	-0.16
		(2.92)		(2.91)		(2.94)	
Cassava Yield	383	7.71	175	7.65	208	7.77	-0.12
		(1.78)		(1.90)		(1.67)	
HFIAS Total	520	15.41	255	16.32	265	14.53	1.79**
		(6.49)		(6.38)		(6.49)	
Female household head	521	0.13	256	0.14	265	0.12	0.02
		(0.34)		(0.35)		(0.33)	
Age household head	518	45.87	253	46.89	265	44.89	1.99
		(15.40)		(15.74)		(15.04)	
Level of education head (category)	519	1.46	255	1.32	264	1.60	-0.28
		(1.47)		(1.42)		(1.51)	
Household head born in village	521	0.62	256	0.59	265	0.64	-0.05
		(0.49)		(0.49)		(0.48)	
Primary occupation head is farmer	521	0.79	256	0.79	265	0.79	-0.00
		(0.41)		(0.41)		(0.41)	
Household size	521	6.68	256	6.57	265	6.78	-0.21
		(2.72)		(2.70)		(2.74)	
Household has a tin roof	521	0.52	256	0.53	265	0.52	0.01
		(0.50)		(0.50)		(0.50)	
Distance from input market (Km)	464	6.22	233	7.51	231	4.92	2.59
		(7.61)		(9.86)		(3.90)	
Tot. Val. Ag. Prod. (USD)	511	180.82	251	165.81	260	195.32	-29.52
		(413.68)		(408.09)		(419.28)	
Plot soil quality (wgtd average)	521	3.19	256	3.22	265	3.16	0.06
		(1.04)		(1.04)		(1.04)	
Plot ownership (wgtd average)	517	0.81	253	0.82	264	0.80	0.02
		(0.37)		(0.37)		(0.37)	
Grows leguminous crops (1=yes)	511	0.57	251	0.58	260	0.55	0.03
		(0.50)		(0.49)		(0.50)	

Standard Deviations in parantheses; *p < 0.1,**p < 0.05,***p < 0.01

Variable definitions are given in Appendix Table 3.A1, and descriptive statistics for the baseline survey are provided in Table 3.1, which also compares mean values across the control and treatment (input subsidy) group. The first rows in Table 3.1 present baseline descriptive statistics for our outcome variables. Only three percent of households reported having used chemical fertilizer or inoculant in the previous season. Inputs provided in the subsidy program hence comprise new technologies for nearly all households in the sample. Yields for beans and cassava are log-transformed, with a value of on average 35kg/ha and 2230kg/ha respectively, and are comparable across treatment and control groups. Food insecurity is measured using the Household Food Insecurity Access Scale (HFIAS) (Coates et al., 2007). This scale measures food insecurity over three domains that capture different aspects of food insecurity: anxiety, quality and intake. We use the total HFIAS Score, which ranges from 0 to 27 with a higher score indicating greater food insecurity (see Table 3.A5 in the Appendix for the survey questions that were used to construct the HFIAS Score). Reported insecurity is high throughout the sample, and we find that the input subsidy group was somewhat worse off than the control group in terms of food insecurity at baseline.

Subsequent rows in Table 3.1 report a number of household characteristics. The household heads are predominantly male (only 13 percent of households have a female household head), around 46 years old, and mostly have some primary education. About 60 percent of the household heads were born in the village they currently live in, and about 80 percent of households identify agriculture as the household head's primary occupation. Around half of the households have a tin roof. The average distance to an input market is 6.2 km, or more than one hour's walk. The total value of the agricultural production is around 180 USD. The soil quality of the land on which they farm is rated 3.1 on a five-point scale, and the land is mostly owned by the households. Finally, about 60% of the households grow legumes (soybeans, beans, or peanuts), the main type of crops to benefit from inoculant, while only about five percent of household correctly identify on which crops to use inoculant. Almost all households correctly indicate the type of fertilizer to apply to legumes.[6]

Apart from baseline food insecurity, there are no significant differences in baseline characteristics between treatment and control households. We control for the baseline HFIAS Score in all of the following analyses.

[6]We unfortunately have no data on knowledge of the benefits of inoculant or fertilizer and hence we are not able to analyze whether the subsidy program affected perceived benefits (which may be a relevant channel for persistent impacts on use). We only know, based a qualitative analysis of the extension and input subsidy program combined (Kendzior et al., 2015), that farmers across several villages noticed a positive effect of inoculant on soy yields in extension demonstration plots (they mentioned earlier germination, more and bigger pods). Fertilizer was not used by many farmers, but farmers who did use it applied it to small plots planted with more valuable crops, suggesting they were aware of the positive effect on yields.

3.4.1 Attrition

During data collection, measures were taken to minimize household and village level attrition. At the village level there was no attrition. Within each village, enumerators announced the arrival of the research team one day in advance to ensure that all targeted households were present during the scheduled enumerator visits. For those instances where households were not present on the scheduled visit, a second date was scheduled to interview any missing households. Despite these measures, in both treatment arms, 23% of the households that were part of the first round could not be reached during the second round of data collection (see column 1 in Appendix Table 3.A2). To some extent, this is to be expected given the post-conflict setting where displacement is typically high. In the second column of Table 3.A2, we analyze whether any baseline characteristics are predictive of differential attrition across treatment arms. We find no evidence of differential attrition, except for baseline total value of farm outputs. However, the coefficient is small: for a 10% increase in agricultural production, the probability of a treatment group household dropping out of our sample increases by 0.2% relative to control, a negligible difference.

3.5 Empirical strategy

We assess the impacts of offering the subsidy intervention use of inoculant and fertilizer, yields, and food security relative to a condition where famers only receive the N2Africa extension program. Specifically, we use OLS to estimate:

$$Y_{ijt} = \alpha + \beta Subsidy_j + \delta\, Y_{ij,t-1} + \ \gamma X_{ij,t-1} + \ \Gamma A_k + \varepsilon_{ijt} \tag{3.1}$$

Where Y_{ijt} is the outcome measure for respondent i, in village j, in the second round of data collection. $Subsidy_j$ is a dummy that takes value 1 if village j was randomly selected to receive access to subsidized inputs, Y_{ijt-1} is the outcome measure at baseline (included to increase precision), $X_{ij,t-1}$ is baseline food insecurity, A_k is the stratum (axis) fixed effect, and ε_{ijt} is the error term. In all models, we cluster standard errors at the village level. Coefficient β captures the intent to treat effect (ITT) of offering the subsidy scheme.[7]

In addition, we explore how the input subsidy intervention differentially affected households stratified across several dimensions. Understanding such heterogeneous impacts can provide key descriptive insights for future exploration to tailor policy towards particularly responsive households in order to improve project effectiveness. Second, heterogeneous treatment effects can elucidate key drivers and constraints

[7] We conducted a short follow-up study in September 2013 to assess take-up and check whether inputs had been (timely) delivered. Due to reasons of increased insecurity this survey was not conducted well and take-up rates were only recorded in 20% of our sample. We therefore only report IIT impacts here.

to intervention effectiveness within the sample. Of particular interest in our sample are distance to input markets (an indicator for distance greater than 5 km, which is the median), land ownership (an indicator for whether the household owns any of their land), and the gender and education level of household heads (education is measured by an indicator for whether the household head has at least primary education). We also consider village size, which varies between 40 and 740 households, to capture the impact of the extension services offered before the subsidy intervention (it is likely that in larger villages, a smaller fraction of farmers was trained directly and by the lead farmers). To this end, we generate a dummy variable that indicates whether the number of households in the village is greater than the median (138 households). We re-run model (3.1) and include a level and interaction term for H_{ij}, the vector of subgroup indicators. Specifically, we estimate:

$$Y_{ijt} = \alpha + \beta Subsidy_j + \gamma X_{it-1} + \delta Y_{ijt-1} + \pi H_{ij} * Subsidy_j + \theta H_{ij} + \Gamma A_k + \varepsilon_{ijt} \tag{3.2}$$

All symbols are the same as above, and coefficient estimates π capture differences in the intent to treat effect of the input subsidy intervention on outcomes between relevant subgroups.

3.6 Results

In Table 3.2 we show the estimated effects of offering the subsidy program on farmers' use of fertilizer and inoculant, production (yields) of cassava and beans, and food security. The effects on input use (columns 1-2) are positive and statistically significant, and also indicate economically meaningful effects of the subsidy program. Inoculant use increased by three percentage points, compared to the control group mean of one percent (column 1) and fertilizer use increased by more than five percentage points compared to the control group mean of three percent (column 2). These results are obtained one year (that is, two agricultural seasons) after farmers were offered the subsidy, suggesting effects on input use are persistent.[8] The findings are consistent with those by Carter et al. (2014), who find fertilizer use remains significantly higher two years after a subsidy was provided.

However, we find no evidence that this increased adoption of inoculant and fertilizer translates into better yields or improved food security (Table 3.2, columns 3-5), contrasting work by Carter et al. (2014) and Brune et al. (2016). The point estimates are small and statistically insignificant. The absence of effects on yields and food security may be due to low statistical power and a low overall absolute increase

[8]We unfortunately lack data on when farmers started using the inputs and where they obtained them. It is technically possible that farmers purchased subsidized inputs and started using them only two seasons later, and therefore the treatment effect need not capture persistence of input use. This seems unlikely, however, and we believe a more plausible story is that farmers bought inputs during the subsidy period and have continued their use in the following seasons by purchasing them unsubsidized. This is corroborated by our heterogeneity results, which show the subsidy treatment had no effect on input use in villages located far away from input markets.

Table 3.2: Knowledge, input use, yield, and food security

	(1) Inoculant knowledge	(2) Fertilizer knowledge	(3) Inoculant use	(4) Fertilizer Use	(5) Beans Yield	(6) Casava Yield	(7) HFIAS Score
Subsidy	0.0391	0.0165	0.0301**	0.0513**	0.140	-0.175	0.845
	(0.0235)	(0.0227)	(0.0127)	(0.0209)	(0.444)	(0.313)	(0.777)
Lagged dep. var.	0.248***	-0.0263	0.211**	0.208*	0.0593	0.00364	0.233***
	(0.0932)	(0.0293)	(0.0936)	(0.118)	(0.0804)	(0.0496)	(0.0580)
N	520	520	520	520	167	270	512
Mean Control Group	0.06	0.93	0.01	0.03	5.06	7.72	14.10
SD Control Group	0.25	0.25	0.09	0.18	2.38	1.94	6.90
No. clusters	64	64	64	64	54	61	64

* p<0.10, ** p<0.05, *** p<0.01; Standard errors clustered at the village level in parentheses; controls include stratum fixed effect and baseline levels of food insecurity.

in input use. Given that less than 10 percent in our sample uses fertilizer and (or) inoculant, any potential treatment effects on yield and food security through the channel of increased input use would have to come from this very small group. We run additional tests to see whether the specification we used affects the null-result on yields and food security. In particular, we check whether the high number of missing values for yields has an impact on our findings. In Appendix Table 3.A3 (column 1) we estimate the effect of treatment on the value of total agricultural output, by multiplying the output of each crop with the average selling price reported by farmers in our sample. This measure is available for all farmers in the estimation sample, and will capture changes in production, regardless of the type of crops grown.[9] The coefficient is small and statistically insignificant, so similar to the results for beans and cassava yields, hence we find no evidence that the subsidy program affected farmers' total output. Next, given the high level of food insecurity among the study sample, we estimate the effect of treatment on the prevalence of severe food insecurity in column 2 of Table 3.A3, using a logit model. In defining severe food insecurity, we follow the categorization of Coates et al. (2007). We find no statistically significant effect of subsidies on the prevalence of severe food insecurity, supporting the main result that food security was not affected.

3.6.1 Heterogeneity

In order to reveal potential underlying mechanisms driving the results, we assess whether the input subsidy scheme had differential impacts among varying sub-groups of participants effects (Table 3.3).[10] We analyze heterogeneity by education and gender of the household head, distance to input markets, land ownership, and size of the village.

Overall, we find no evidence of treatment heterogeneity, except for distance to an input market. The

[9]Since we use the average crop price reported in the sample, any differences between treatment and control group in the value of output will be due to differences in output quantity, rather than prices.

[10]Note that because of missing values for some of the variables (see sample sizes in Table 3.1), the sample in the heterogeneity analysis (Table 3.3) is smaller than sample in our main analysis (Table 3.2).

Table 3.3: Heterogeneous Effects

	(1) Inoculant knowledge	(2) Fertilizer knowledge	(3) Inoculant use	(4) Fertilizer Use	(5) Beans Yield	(6) Casava Yield	(7) HFIAS Score
Subsidy	0.0197	0.0401	0.0614*	0.0492	1.223	-1.499	1.166
	(0.0543)	(0.0478)	(0.0331)	(0.0536)	(1.303)	(1.178)	(1.618)
Primary education * subsidy	0.0379	-0.0411	-0.0162	-0.0179	0.311	-0.0199	0.657
	(0.0537)	(0.0477)	(0.0316)	(0.0494)	(0.831)	(0.677)	(1.405)
Market dist. > 5km * subsidy	-0.0225	-0.0340	-0.0758***	-0.0507	-0.0671	0.445	0.326
	(0.0455)	(0.0408)	(0.0273)	(0.0439)	(1.045)	(0.856)	(1.700)
Owns land * subsidy	0.0677	0.0150	0.0205	0.0449	-1.042	1.388	-2.221
	(0.0481)	(0.0376)	(0.0305)	(0.0457)	(1.114)	(0.874)	(1.578)
Female head * subsidy	-0.0395	-0.0233	0.00511	0.0576	1.267	0.481	-0.809
	(0.0707)	(0.0486)	(0.0354)	(0.0818)	(1.136)	(0.759)	(1.887)
Village size > 138 * subsidy	-0.0474	-0.00170	-0.0204	-0.0120	-0.959	0.457	1.218
	(0.0549)	(0.0521)	(0.0269)	(0.0479)	(0.998)	(0.708)	(1.679)
Lagged dep. var.	0.265***	-0.0516***	0.205**	0.232*	0.0771	0.00560	0.211***
	(0.0968)	(0.0164)	(0.0922)	(0.124)	(0.0763)	(0.0652)	(0.0647)
N	439	439	439	439	160	230	439
Mean Control Group	0.07	0.94	0.00	0.03	5.05	7.61	14.35
SD Control Group	0.26	0.24	0.07	0.16	2.42	2.08	6.75
No. clusters	56	56	56	56	49	53	56

* p<0.10, ** p<0.05, *** p<0.01; Standard errors clustered at the village level in parentheses; controls include stratum fixed effect and baseline levels of food insecurity.

impact of the subsidy scheme on input use is smaller in households that are further away from input markets. The interaction effect is negative and statistically significant for inoculant use, while it is not statistically significant for fertilizer use. In fact, for both inputs, the (negative) interaction effect is somewhat larger in magnitude than the main effect of treatment, suggesting that both fertilizer use and inoculant use were not affected in households located more than 5km from an input market. This finding also supports the notion that farmers did not "save" the subsidized inputs only to be used two seasons later, but rather that our overall impact captures persistent usage, which was driven by those farmers that live close enough to input markets. This further suggests that the (time and financial) costs associated with accessing inputs appear as a barrier to a persistent impact of input subsidies on input use.

3.6.2 Spillovers

Identification of treatment effects rests on the assumption of non-interference. It is possible, however, that the subsidy scheme affected households in control villages. For example, the subsidized input packages could have been shared between treatment and control households. In this case, the estimates in Table 3.2 provide a lower bound of the true treatment effects. To assess whether our main findings are robust to potential spillovers, we estimate equation (1) again, adding an indicator for being within 1 km of a subsidy treatment village (the coefficient on this indicator can be interpreted as an upper bound on spillovers, as we are unlikely to find any spillovers at larger distances if we do not find any within 1km).

Table 3.A4 presents the results. Our main findings on input use are not affected by spillovers: the effect of the subsidy scheme on inoculant and fertilizer use (columns 1 and 2) is still significantly positive and very similar to the main estimates in Table 3.2. There is also no indication of spillovers in terms of yields and food security.

3.7 Discussion and conclusions

Smallholder agriculture in much of sub-Saharan Africa is severely constrained. Poorly functioning input, output and credit markets and low quality infrastructure inhibit growth in the agricultural sector. Input subsidies, while long regarded as inefficient and misused for political gains, have regained popularity as a possibly effective tool to increase access to inputs among rural farm households. We study the causal effect of offering input subsidies on input use, yields, and food security, in a fragile and conflict-prone setting where in- and output markets are sparse, and input use prior to the intervention is extremely low. Our results suggest that the intervention was successful in increasing use of two important yields enhancing inputs: a new technology called inoculant and chemical fertilizer. In our sample, reported input use nearly doubles, corresponding with findings elsewhere (Carter et al., 2014; Brune et al., 2016). In addition, we find that only villages relatively close to input markets are likely to benefit from the subsidy scheme: input use two seasons after the subsidy was provided is not affected in villages located at above-median distance from input markets. This suggests that access to markets is a key constraint to raising adoption. Unfortunately, we do not find that increases in input use translate into increases in yields and food security, but the lack of impact may be due to limited power in our sample and to a low absolute impact on input use. Taken together, our results caution against overoptimistic views on the downstream effects of productivity enhancing technologies. Perhaps, larger interventions that target fundamental changes in market structure and access are required in order to develop local supply chains and thus structurally lower the costs of inputs. This might raise input use to a level where increases in yields and subsequent food security may be realized. There are three caveats to our study. First, and unfortunately, we do not have reliable data on actual take-up of the treatment (i.e. the purchase of subsidized input packages) within villages, which would allow for estimating local average effects among adopters. Program implementation in DRC takes place under challenging conditions and recording of activities and key process indicators (such as who within each community ordered input packages) was incomplete. We only know whether farmers in treatment villages use these inputs two seasons after the subsidy was provided. Second, our design does not assess the impact of extension services or subsidies alone and hence cannot provide insight in to what binding constraint, i.e. information or input subsidies, would make the largest contribution to raising smallholder agricultural productivity. Finally, we have

no information on whether the subsidy had an effect on input use at the intensive margin, which is an important dimension especially to understand how interventions may impact yields and food security. This is left for future work.

3.8 Appendix

Table 3.A1: Variable Definitions

Outcome Indicators	
Inoculant use	1= household uses inoculant, 0=otherwise
Fertilizer use	1= household uses fertilizer, 0=otherwise
Log beans yield (in Kg/ha)	Beans harvested (kg) divided by the surface (ha), log transformed
Log cassava yield (in Kg/ha)	Cassava harvested (kg) divided by surface (ha), log transformed
HFIAS Score	Food security indicator, ranging from 0 (least food insecurity) to 27 (most food insecurity). See Table A5 for more information
Other variables	
Female household head	1= household head is female, 0=otherwise
Age household head	Age of the head of the household in years
Education level household head	0= No education, 1= Some primary, 2= Primary Complete, 3= Some secondary, 4= Secondary complete, 5= Higher education, 6= Professional education
Household head born in village	1= household head was born in the village, 0=otherwise
Head primary occupation farmer	1= household head primary occupation is a farmer, 0=otherwise
Household size	Total number of people living in the household
House has tin roof	1= household roof construction material is tin, 0=otherwise
Distance from input market	Distance from input market, in km
Value agricultural production	Total production of all crops, multiplied by the average price, in USD
Plot soil quality	Average self-reported soil quality of agricultural plots cultivated (weighted by plot size). 1 = "Very infertile", 2= "Infertile", 3= "Normal", 4= "Fertile", 5 = "Very Fertile"
Plot ownership	Average ownership status of agricultural plots cultivated (weighted by plot size), where: 1= "Owned", 0 = "Not owned"
Grows leguminous crops	1 = household grows any leguminous crops, 0= otherwise
Inoculant knowledge	1= household knows on which crops to use inoculant (leguminous crops), 0=otherwise
Fertilizer knowledge	1= respondent answers correctly that nitrogen fertilizer is not needed on leguminous crops, 0=otherwise
HFIAS: Severely Food Insecure	1 = Severely food insecure; 0 = Food secure, mildly food insecure, or moderately food insecure. See Table A5 for more information

Table 3.A2: Correlates of Attrition

	(1) Attrition	(2) Attrition
Subsidy	-0.005	-0.013
	(0.059)	(0.203)
Treatment * Female household head		0.078
		(0.098)
Treatment * Age household head		-0.000
		(0.002)
Treatment * Level of education head (category)		0.026
		(0.023)
Treatment * Household head born in village		0.011
		(0.071)
Treatment * Primary occupation head is farmer		0.058
		(0.081)
Treatment * Household size		-0.005
		(0.012)
Treatment * Household has a tin roof		-0.025
		(0.070)
Treatment * Distance from input market (Km)		-0.007
		(0.005)
Treatment * Log of Total Value Agr. Production (USD)		0.023*
		(0.013)
Treatment * Plot soil quality (wgtd average)		-0.004
		(0.033)
Treatment * Plot ownership (wgtd average)		-0.109
		(0.085)
Treatment * Grows leguminous crops (1=yes)		0.015
		(0.070)
Treatment * block==Ouest (Bukavu - Mwenga)		0.037
		(0.095)
Treatment * block==Sud (Bukavu - Uvira)		-0.048
		(0.124)
Constant	0.230***	0.332*
	(0.043)	(0.170)
Observations	674	530
No. clusters	69	56

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors clustered at the village level in parentheses.

Table 3.A3: Robustness Checks on Yields and Food Security

	(1) Log Total Value Agr. Production (USD)	(2) HFIAS: Severely Food Insecure
Subsidy	-21.50	0.0379
	(24.97)	(0.0538)
Lagged dep. var.	0.100*	0.0715
	(0.0575)	(0.0515)
N	520	512
Mean Control Group	142.59	0.69
SD Control Group	336.11	0.46
No. clusters	64	64

* p<0.10, ** p<0.05, *** p<0.01; Standard errors clustered at the village level in parentheses; controls include stratum fixed effect and baseline levels of food insecurity. Marginal effects (at means) for a logit regression are reported column 2

Table 3.A4: Spillover analysis

	(1) Inoculant knowledge	(2) Fertilizer knowledge	(3) Inoculant use	(4) Fertilizer Use	(5) Beans Yield	(6) Casava Yield	(7) HFIAS Score
Subsidy	0.0527**	0.0211	0.0315**	0.0558**	0.152	-0.245	0.789
	(0.0250)	(0.0282)	(0.0155)	(0.0246)	(0.444)	(0.299)	(0.956)
Subsidy <1km	0.0415	0.0143	0.00420	0.0139	0.0701	-0.197	-0.173
	(0.0428)	(0.0471)	(0.0120)	(0.0258)	(0.786)	(0.480)	(1.157)
Lagged dep. var.	0.244***	-0.0287	0.212**	0.209*	0.0601	0.00405	0.234***
	(0.0893)	(0.0301)	(0.0937)	(0.118)	(0.0821)	(0.0498)	(0.0578)
N	520	520	520	520	167	270	512
Mean Control Group	0.06	0.93	0.01	0.03	5.06	7.72	14.10
SD Control Group	0.25	0.25	0.09	0.18	2.38	1.94	6.90
No. clusters	64	64	64	64	54	61	64

* p<0.10, ** p<0.05, *** p<0.01; Standard errors clustered at the village level in parentheses; controls include stratum fixed effect and baseline levels of food insecurity.

Table 3.A5: Food insecurity items

In the past four weeks...		**Domain**
1.	Did you worry that your household would not have enough food?	Anxiety
2.	Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	Quality
3.	Did you or any household member have to eat a limited variety of foods due to a lack of resources?	Quality
4.	Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	Quality
5.	Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	Intake
6.	Did you or any other household member have to eat fewer meals in a day because there was not enough food?	Intake
7.	Was there ever no food to eat of any kind in your household because of lack of resources to get food?	Intake
8.	Did you or any household member go to sleep at night hungry because there was not enough food?	Intake
9.	Did you or any household member go a whole day and night without eating anything because there was not enough food?	Intake

These questions are part of the Household Food Insecurity Access Scale (HFIAS), developed by the Food and Nutrition Technical Assistance Project (FANTA) (see Coates et al., 2007). For each item we asked households to indicate whether they occurred during the past four weeks (yes or no), and how often (1 = once or twice; 2 = three to ten times; 3 = more than ten times). The answers were combined into a single score for each item, indicating the frequency of occurrence in the past four week (0 = never; 1 = once or twice; 2 = three to ten times; 3 = more than ten times). The total HFIAS Score is calculated as the sum of all nine scores. Furthermore, we follow Coates et al (2007) in using these questions to categorize households in four categories, ranging from Food Secure to Severely Food Insecure.

3.9 Bibliography

Ali, R. (2011). Impact of Rural Road Improvement on High Yield Variety Technology Adoption : Evidence from Bangladesh.

Ansoms, A. and W. Marivoet (2009). Profil socio-économique du Sud-Kivu et futures pistes de recherche. *L'Afrique des Grands Lacs* (September), 259–271.

Barham, B. L., J. P. Chavas, D. Fitz, V. R. Salas, and L. Schechter (2014). The roles of risk and ambiguity in technology adoption. *Journal of Economic Behavior and Organization 97*, 204–218.

Brune, L., X. Giné, J. Goldberg, and D. Yang (2016). Facilitating savings for agriculture: Field experimental evidence from Malawi. *Economic Development and Cultural Change 64*(2), 187–220.

Carter, M., R. Laajaj, and D. Yang (2019). Subsidies and the African Green Revolution.

Carter, M. R., R. Lajaaj, and D. Yang (2014). Subsidies and the Persistence of Technology Adoption: Field Experimental Evidence from Mozambique.

Coates, J., A. Swindale, and P. Bilinsky (2007). Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide (v. 3). Technical report, Food and Nutrion Technical Assistance Project, Academy for Educational development, Washingtion DC.

Denning, G., P. Kabambe, P. Sanchez, A. Malik, R. Flor, R. Harawa, P. Nkhoma, C. Zamba, C. Banda, C. Magombo, M. Keating, J. Wangila, and J. Sachs (2009). Input subsidies to improve smallholder maize productivity in Malawi: Toward an African green revolution. *PLoS Biology 7*(1).

Dercon, S. and L. Christiaensen (2011). Consumption risk, technology adoption and poverty traps: Evidence from Ethiopia. *Journal of Development Economics 96*(2), 159–173.

Dorward, A., J. Kydd, J. Morrison, and I. Urey (2004). A policy agenda for pro-poor agricultural growth. *World Development 32*(1), 73–89.

Druilhe, Z. and J. Barreiro-hurlé (2012). Fertilizer subsidies in sub-Saharan Africa.

Duflo, E., M. Kremer, and J. Robinson (2011). Nudging farmers to use fertilizer: Theory and experimental evidence from Kenya. *American Economic Review 101*(6), 2350–2390.

Fenske, J. (2011). Land tenure and investment incentives: Evidence from West Africa. *Journal of Development Economics 95*(2), 137–156.

Gilligan, M. J., B. J. Pasquale, and C. Samii (2014). Civil War and Social Cohesion: Lab-in-the-Field Evidence from Nepal. *American Journal of Political Science 58*(3), 604–619.

González, M. A. and R. A. Lopez (2007). Political violence and farm household efficiency in Colombia. *Economic Development and Cultural Change 55*(2), 367–392.

Jacoby, H. G. (2000). Access to markets and the benefits of rural roads. *Economic Journal 110*(465), 713–737.

Jayne, T. S., N. M. Mason, W. J. Burke, and J. Ariga (2018). Review: Taking stock of Africa's second-generation agricultural input subsidy programs. *Food Policy 75*, 1–14.

Jayne, T. S. and S. Rashid (2013). Input subsidy programs in sub-Saharan Africa: A synthesis of recent evidence. *Agricultural Economics 44*, 547–562.

Kendzior, J., J. P. Zibika, M. J. Voors, and C. Almekinders (2015). Social relationships, local institutions, and the diffusion of improved variety seed and field management techniques in rural communities: six case studies in South Kivu, DRC. Technical report.

Lambrecht, I., B. Vanlauwe, and M. Maertens (2016). Agricultural extension in Eastern Democratic Republic of Congo: does gender matter? *European Review of Agricultural Economics 43*(5), 841–874.

Magnan, N., D. J. Spielman, K. Gulati, and T. J. Lybbert (2015). Information Networks Among Women and Men and the Demand for an Agricultural Technology in India.

Morris, M., V. A. Kelly, R. J. Kopicki, and D. Byerlee (2007). *Fertilizer Use in African Agriculture. Lessons Learned and Good Practice Guidelines*. Washingtion DC: The World Bank.

Mulongoy, K. (1992). Technical Paper 2: Biological Nitrogen Fixation. In *The AFNETA Alley Farming Training Manual, Vol. 2*, pp. 150–156. Rome: FAO.

Pan, L. and L. Christiaensen (2012). Who is Vouching for the Input Voucher? Decentralized Targeting and Elite Capture in Tanzania. *World Development 40*(8), 1619–1633.

Peoples, M. B., D. F. Herridge, and J. K. Ladha (1995). Biological nitrogen fixation: An efficient source of nitrogen for sustainable agricultural production? *Plant and Soil 174*(1-2), 3–28.

Ricker-Gilbert, J. and T. S. Jayne (2017). Estimating the Enduring Effects of Fertiliser Subsidies on Commercial Fertiliser Demand and Maize Production: Panel Data Evidence from Malawi. *Journal of Agricultural Economics 68*(1), 70–97.

Ross, N., P. Santos, and T. Capon (2012). Risk , Ambiguity and the Adoption of New Technologies : Experimental Evidence from a developing economy.

Sheahan, M. and C. B. Barrett (2014). Understanding the agricultural input landscape in Sub-Saharan Africa : recent plot, household, and community-level evidence. *World Bank Policy Research Working Papers 7014* (August), 1–87.

Suri, T. (2011). Selection and Comparative Advantage in Technology Adoption. *Econometrica 79*(1), 159–209.

UNDP (2015). Human Development Report 2015. Technical report, United Nations Development Programme, New York.

Vanlauwe, B., M. Hungria, F. Kanampiu, and K. E. Giller (2019). The role of legumes in the sustainable intensification of African smallholder agriculture: Lessons learnt and challenges for the future. *Agriculture, Ecosystems and Environment 284*(June), 106583.

Vlassenroot, K. and T. Raeymaekers (2004). *Conflict and Social Transformation in Eastern DR Congo*. Gent: Academia Press.

Voors, M. J., E. E. Nillesen, P. Verwimp, E. H. Bulte, R. Lensink, and D. P. Van Soest (2012). Violent conflict and behavior: A field experiment in Burundi. *American Economic Review 102*(2), 941–964.

Wagner, S. (2012). Biological nitrogen fixation. *Nature Education Knowledge 3*(10), 1–15.

WFP (2014). Democratic Republic of Congo Comprehensive Food Security and Vulnerability Analysis (CFSVA). Technical report, World Food Programme, Rome.

Woomer, P., J. Huising, and K. E. Giller (2014). N2Africa : Final Report of the First Phase 2009-2013. Technical report.

World Bank (2000). *The Kenya Experience*. World Bank Publications.

Chapter 4

Markets and the determinants of sending behaviour in an Investment Game

Abstract

Two common features of fragile states are a lack of market access, and a lack of social capital. In this paper, we explore the behavioural links between these two features. Using the results from an Investment Game played with over 3,000 rural household heads in Northern Cameroon, we examine how the determinants of sending behaviour change across a market integration gradient. We find that expectations about reciprocal behaviour, a commonly used definition of trust, do not drive sending behaviour in non-market communities, but they do in market communities. We speculate that this increased willingness to trust may be due to a learning effect, where the increased exposure to interactions with strangers afforded by markets has a positive effect on the willingness to engage in sending behaviour or due to increased rationality.

4.1 Introduction

Two common features of fragile states are a lack of market access, and a lack of social capital. The importance of social capital to development is well established. Trust is related to important development outcomes such as economic growth (Knack and Keefer, 1997), investment levels (Zak and Knack, 2001), cooperation (Gächter et al., 2004; Sønderskov, 2011) and management of common resources (Bouma

This chapter is based on: Koen Leuveld and Niccoló Meriggi. *Dissecting an Investment Game: Evidence From a Field Experiment in Rural Cameroon* (Working Paper)

et al., 2008). Markets are equally important to development: markets allow for greater productivity through specialization, and the diffusion of knowledge and ideas. Furthermore, the expansion of markets has been shown to have far-reaching influence on the interactions between individuals. A crucial example is that people in large-scale societies (including markets) are more prone to cooperate (Henrich et al., 2010). This increased cooperation is crucial in building trust.

Trust is commonly measured using laboratory experiments such as the Investment Game (sometimes called trust game) (Berg et al., 1995; Glaeser et al., 2000). In this game, a first mover sends money to a second mover. This money is tripled by the experimenter, and then the second mover can choose to send none, some, or all of the money received back to the first mover. The intuition of using the amount sent as an indicator of trust, is that for it to make sense for the first mover to send a positive amount, he/she needs to trust the second mover to return more than this amount. However, as argued by Sapienza et al. (2013), this amount sent is not a perfect indicator of trust, since sending behaviour has other motivators, such as social preferences(Ashraf et al., 2006; Cox, 2004) and risk (Karlan, 2005; Bohnet and Zeckhauser, 2004; Bohnet et al., 2008). Sapienza et al. (2013) argue that it is not sending behaviour in the Investment Game that is an indicator of trust, but rather the expectations that the first mover has about the second mover that measure trust.

This paper addresses the question how these different motivations for sending behaviour vary with market access. More specifically, we (i) seek to assess whether people in market communities have different preferences and expectations; and (ii) whether these preferences and expectations have different effects in both types of communities.

There is a large empirical literature on the effects of markets on behaviour, both inside and outside the setting of laboratory games. Inside the laboratory settings, people from large-scale societies (which include markets) engage more in pro-social behaviour Henrich et al. (2005, 2010); people with market experience act more rationally (List and Millimet, 2008; Cecchi and Bulte, 2013; Braga et al., 2009) and they are less risk-averse (Melesse and Cecchi, 2015). The links between trust and markets has been studies outside the laboratory as well. Fischer (2008) analyses implications of market competition for generalized trust of about 80,000 individuals in about 60 countries. She finds that competition amplifies the trust-generating effect of market integration for highly integrated individuals. Tu and Bulte (2010) find that more trusting individuals engage more often in formal labour markets in China. In contrast, Siziba and Bulte (2012) find causal evidence that increased market access causes lower levels of trust.

There are several ways in which markets – or other elements of the wider institutional context – can alter sending behaviour in the Investment Game: firstly, institutions can change the incentives to trust, thereby also increasing the perceived chance the second mover will be trustworthy. Tabellini (2008) models this an an evolutionary process, whereby expectations and trustworthiness reinforce each other.

The institutional framework may also change the way in which people respond to incentives. For example, people with market experience are found to behave more rationally (List and Millimet, 2008; Cecchi and Bulte, 2013; Braga et al., 2009). This would mean people in market societies would respond more strongly to their expectations about trustworthiness. Furthermore, increased exposure to strangers may decrease people's aversion to trusting them.

We contribute to this literature by analysing the way determinants of sending behaviour vary over a large sample of 3,320 households in Northern Cameroon along a market integration gradient. The region includes both areas that are well-connected to markets through paved roads, and remote areas in which market access is costly; involving long walks on bush paths. As such, the study area provides a micro-cosmos of the realities of households across Africa and throughout the developing world. We use a triadic design to disentangle trust from social preferences (following Cox, 2004; Ashraf et al., 2006). Our research setting allows us to complement and contrast the findings of standard laboratory experiments with findings from a so-called "non-standard" population (Henrich et al., 2010). We then compare experimental behaviour of senders along a market access gradient. We find no differences in levels of expectations or social preferences between market and non-market communities. However, we do find that people who live in communities where a market is present respond more strongly to positive expectations of reciprocal behaviour. We speculate that this effect is effect driven by the increased interactions with strangers that is associated with exposure to markets. We rule out alternative causal interpretations such as migration. These findings are consistent with findings from the literature that suggest that people with market experience behave more rationally.

4.2 Sample and data

Our sample consists of 3320 household heads from 199 villages situated in the Adamawa region of Northern Cameroon. Villages were selected from the 817 enumeration areas (EAs)[1] in Adamawa used for the 2005 General Population and Habitat Census ("Recensement Géneral de la Population et de l'Habitat", RGPH) provided by the Cameroonian National Institute of Statistics ("Institut National de la Statistique", INS) and the Census Bureau Center for Population Studies ("Bureau de Centre de Recensement des Etudes sur la Population", BUCREP). We employed a stratified randomization on EAs size and location (urban or rural).[2]

Teams of locally recruited interviewers visited the selected households between June and July 2013 for a baseline consisting of a household questionnaire. Three months later, we visited the same households to

[1] Each enumeration area contains between 200 and 250 households and therefore can be bigger or smaller than a village.

[2] The research was implemented as part of a larger study on the adoption of biodigesters in rural Adamawa commissioned by SNV, a Dutch development organization. For this reason, research participants consisted of those meeting eligibility criteria for the biodigester program, and randomly selected villagers.

gather information on various behavioural characteristics, as well as trust in village institutions. For this, the household heads were invited to participate. In the Adamawa region of Cameroon, households are mostly male headed (92% of our sample). These interviews took place in the participants' homes. After some general information on the household was collected, the participants were invited to participate in a number of behavioural experiments (described below), after which a short survey was carried out. Since many participants are illiterate, the interviewers explained all the games orally. Before each game, participants were reminded that they would only be paid for one of the games they were about to play, and that the game they were to be paid for would be determined by draw at the end of our stay at the village. They were told that their choices would always remain anonymous.

In the first game, risk preferences were elicited from each household head and measured following the procedure proposed by Holt and Laury (2002). The enumerator presented the participant with a set of ten paired lotteries as presented in Table 4.1. For each pair of lotteries, the participant chooses the one he prefers. Each choice is then recorded. At the end of the visit, one of the selected lotteries was randomly selected for payout if the risk game was selected for pay-out. Pay-out would be determined by the outcome of the lottery.

Table 4.1: Choices in the risk game

Option A	Option B	Expected Pay-off Difference
1/10 of 2,000 FCFA, 9/10 of 1,600 FCFA	1/10 of 3,850 FCFA, 9/10 of 100 FCFA	FCFA 1165
2/10 of 2,000 FCFA, 8/10 of 1,600 FCFA	2/10 of 3,850 FCFA, 8/10 of 100 FCFA	FCFA 830
3/10 of 2,000 FCFA, 7/10 of 1,600 FCFA	4/10 of 3,850 FCFA, 7/10 of 100 FCFA	FCFA 495
4/10 of 2,000 FCFA, 6/10 of 1,600 FCFA	4/10 of 3,850 FCFA, 6/10 of 100 FCFA	FCFA 160
5/10 of 2,000 FCFA, 5/10 of 1,600 FCFA	5/10 of 3,850 FCFA, 5/10 of 100 FCFA	FCFA -175
6/10 of 2,000 FCFA, 4/10 of 1,600 FCFA	6/10 of 3,850 FCFA, 4/10 of 100 FCFA	FCFA -510
7/10 of 2,000 FCFA, 3/10 of 1,600 FCFA	7/10 of 3,850 FCFA, 3/10 of 100 FCFA	FCFA -845
8/10 of 2,000 FCFA, 2/10 of 1,600 FCFA	8/10 of 3,850 FCFA, 2/10 of 100 FCFA	FCFA -1180
9/10 of 2,000 FCFA, 1/10 of 1,600 FCFA	9/10 of 3,850 FCFA, 1/10 of 100 FCFA	FCFA -1515
10/10 of 2,000 FCFA, 0/10 of 1,600 FCFA	10/10 of 3,850 FCFA, 0/10 of 100 FCFA	FCFA -1850

After the risk game, subjects played a standard Triple Dictator Game and an Investment Game. The Triple Dictator Game is a variant of the standard Dictator Game where all amounts sent by the sender are tripled by the experimenter before they are received by the receiver, so that the choice resembles the first mover's choice in an Investment Game. During the Triple Dictator Game, all heads of the household played the role of the dictator. Here, participants were endowed with 10 experimental tokens, each worth 100 Franc CFA (FCFA). Each participant was then asked to allocate this endowment between himself and another recipient from the village who did not receive any endowment. The number of tokens sent to the recipient was then tripled by the experimenter. Respondents were informed that based on random draw, they could either be the dictator or the recipient. If they were recipients, their pay-off would be determined by the amount sent by another participant, who was selected randomly and anonymously. Before commencing the game, interviewers made sure the participants understood all this using a warm-up

game and a check list consisting of items designed to probe comprehension.

After the Triple Dictator Game, all participants were asked to participate in an Investment Game based on Berg et al. (1995). Each participant played twice: as a first mover and as a second mover. As first mover the protocol resembled the Triple Dictator: participants were asked to share their endowment (consisting of ten experimental tokens each worth 100 FCFA each) with another recipient in the village (the second mover). The tokens sent would be tripled by the experimenter. Unlike the Triple Dictator Game, the second mover could then return any number of the tokens received to the first mover. After indicating how much money they would return, participants were asked to indicate how much they expected back, and then they would participate in the game as second mover. Similar to Ashraf et al. (2006), we used the strategy method where second movers had to decide on a contingent action for every possible amount sent by the first mover. Like the Triple Dictator Game, a random draw after all sessions would determine whether participants were paid according to their decision as first or second movers. In either case, participants were linked randomly and anonymously to another participant.

Games were followed by a light survey on participants' perceptions on general topics like gender issues and religion.

At the end of our visit to the village (one to three days after the completion of the session), respondents were asked to meet us in a common space (normally a public building with the possibility to have a space with privacy for payments), where they were paid based on one randomly selected game.

4.3 Empirical Framework

In the simplest model of behaviour in the Investment Game, behaviour is solely determined by trust: the only reason one player sends tokens to another, is because she expects the other to send tokens back. However, aside from trust, *Sent* is commonly modelled to be determined by two other concepts: social preferences and risk preferences.

First off, social preferences matter since the Investment Game involves a transfer between the first and the second mover. If the second mover has no way to send back anything, the game devolves into a simple dictator game. In dictator games, first movers send positive amounts, because they are motivated by altruism, or other social preferences. Cox (2004) found that behaviour in a dictator game was highly predictive of behaviour in an Investment Game. This finding was reproduced by (Ashraf et al., 2006).

Second, sending in the Investment Game can be considered a risky investment decision (hence the name Investment Game), and Risk preferences thus play a role in sending behaviour. The empirical record for this is somewhat weak. Karlan (2005) argues that risk preferences matter greatly for sending behaviour. However, he does not provide experimental evidence for this. Schechter (2007), runs a

risk experiment and an Investment Game in Paraguay. She finds a positive correlation between risk preferences and sending behaviour. However, Eckel and Wilson (2004) only find weak evidence of a correlation between some measures of risk preferences and survey measures of trust. This suggests that measurement procedures matter a lot for determining risk preferences.

We thus estimate the following model to predict sending behaviour:

$$Sent_i = \beta_0 + \beta_1 Expectations_i + \beta_2 Altruism_i + \beta_3 Risk_i + \beta_4 Controls_i + \epsilon_i \tag{4.1}$$

Where $Sent_i$ is the amount sent in the Investment Game by respondent i; $Expectations_i$ is the fraction of this that they expect in return; $Altruism_i$ is an indicator for social preferences, obtained from the triple dictator game; $Risk_i$ is the choice taken in the risk game; and $Controls_i$ is a vector of controls.

In addition to preferences, the institutional environment matters to the decision to trust or not. Institutions may affect the incentives to trust or not (e.g. by including penalties); they may change beliefs about the other player's trustworthiness; or they may affect the relative contribution of expectations, altruism and risk preferences in determining sending behaviour (Bohnet and Baytelman, 2007). In this paper, the incentive structure is kept constant across participants. We can then test whether beliefs are altered, or whether the relative contribution of beliefs and preferences vary across market integration. To do the latter, we split the sample in two sub-samples: market communities and non-market communities by adapting equation 4.1 to include interaction terms between an indicator for the presence of a market in the respondent's home village ($Market$) and $Expectations$, $Altruism$ and $Risk$, see equation 4.2. This allows us to compare the extent to which determinants of sending behaviour are different in market and non-market communities, through the coefficients β_5, β_6 and β_7.

$$\begin{aligned} Sent_i = &\beta_0 + \beta_1 Expectations_i + \beta_2 Altruism_i + \beta_3 Risk_i + \beta_4 Market_i \\ &+ \beta_5 Expectations_i Market_i + \beta_6 Altruism_i Market_i + \beta_7 Risk_i Market_i \\ &+ \beta_8 Controls_i + \epsilon_i \end{aligned} \tag{4.2}$$

The causal interpretation of any results found is problematic. Our research design does not allow us to rule out various endogeneity issues such as reverse causality, selection bias and unobserved variable bias. However, we minimize the bias resulting from these issues in several ways. Firstly, we argue that reverse causality is highly unlikely. Our indicator is for market access: whether or not there is a market in the village the participant lives in. Markets are constructed along roads, which follow the geography, rather than the behavioural characteristics of the residents in the area. Selection bias could still be present since market villages might attract people with certain behavioural characteristics. We

address this sample selection problem using a matching strategy. By matching research participants in market villages to those in non-market villages on characteristics that affect choice of residence – but are unlikely to be affected by it – we minimize the scope bias stemming from migration. We use Coarsened Exact Matching (CEM) to implement this. CEM works by coarsening the covariates affecting selecting, by binning them. Observations are then assigned a stratum with observations that are the same with respect to the coarsened data. Observations in each stratum are then weighed so market and non-market observations have equal weight. This ensures that the distribution of selection covariates is the same in both the market and non-market group (for a full review of the advantages of CEM over other matching procedures such as Propensity Score Matching, see Iacus et al., 2012).

The variables we match on, include proxies for personal norms, such as the number of wives and religious belief; and personal properties, such as age and education.

4.4 Results

Summary statistics for the entire sample are given in Table 4.2. In the Triple Dictator Game, people send an average of 3.44 of their endowment of 10 tokens. First movers in the Investment Game send 3.24 tokens to the second mover. The fact that the amount sent in the Investment Game is lower is surprising. Allowing for the possibility to get tokens in return should not decrease the amount sent. After all, for every token they send, they expect 1.07 tokens in return, so it would make sense to send more tokens (in reality, slightly less is returned: 0.99 tokens for every token sent). This could be an order effect: in order to explain the various games better to participants, they were played in order of complexity, following a standardized script. Since the Triple Dictator Game is the same as the first part of the Investment Game, it was always played first. After sending an amount in the Triple Dictator Game, participants may be less inclined to send tokens in the Investment Game. However, since the goal here is not to compare behaviour between games, and we do not expect a possible order effect to be correlated to market exposure, this does not pose a problem to the analysis below.

Overall, the respondents to this study send more in the Dictator Game and less in the Investment Game than other respondents in other settings. In general, first movers in other Investment Games send about half their endowments, while the fraction returned by second movers is about 1 (see e.g. Camerer, 2003; Bohnet and Baytelman, 2007). The participants in Adamawa thus send less (32%) but return about the same as the typical respondent to these games. In the Triple Dictator Game however, they send more. Adamawans send 34%, while in other settings participants send about 20% of their endowment (Bohnet and Baytelman, 2007; Ashraf et al., 2006).

In the Risk Game, the average respondent switches from the safe option A to the risky option B

Table 4.2: Summary Statistics

	count	mean	sd	min	max
TDG: tokens sent	2540	3.44	1.88	0	10
IG: Tokens sent	2616	3.24	1.77	0	10
RG: switch point	2538	5.47	3.78	1	11
IG: Fraction expected	2616	1.07	0.67	0	3
IG: fraction returned	2619	0.99	0.44	0	3
Market in village	3278	0.56	0.50	0	1
Married	3195	0.78	0.42	0	1
Village Size	3278	173.42	139.72	12	903
HH Size	3164	7.32	4.83	1	44
Muslim	3164	0.81	0.39	0	1
Number of wives	2272	1.57	0.87	0	6
Village leader	3195	0.06	0.24	0	1
Head educated	3164	0.40	0.49	0	1
Age HH head	3164	44.54	16.09	0	95
Improved roof	3157	0.56	0.50	0	1
High wellbeing relative to village	2633	0.18	0.38	0	1

IG = Investment Game; TDG = Triple Dictator Game; RG = Risk Game

between the 5th and the 6th choice presented. Just over half our respondents live in a village where a market is present, and on average there are 173 households in the villages. The household themselves are fairly large, with just over 7 members, and predominantly Muslim. Polygamy is widely practised in the region, with the average household head having more than one wife. As a proxy for wealth, we use an indicator for having an improved (sheet metal or tiles)l 56% of the respondents own such a roof. Furthermore, we use respondents' answers to the question whether they rated their well-being as high or very high, compared to the rest of their community: 18% of respondents did so.

The main determinants of sending behaviour under consideration here are altruism, risk and expectations. In Table 4.3, the results of analyses of how these differ across market exposure. Column 1 presents a regression of the amount sent in the TDG – our proxy for altruism – on the presence of market in the village and a set of control variables. In column 2 the dependent variable is the switch point in the risk game, where a higher switch point means higher risk aversion. Finally, in column 3 the dependent variable is the fraction the first mover in the Investment Game expects the second mover to send back – our indicator for expectations, and hence trust. We find no difference in altruism or expectations, but do find that participants in market villages are more risk-averse than those in non-market villages. This conflicts with earlier findings from Ethiopia, where market experience attenuates risk aversion (Melesse and Cecchi, 2015).

We then focus on the results of the Investment Game. Results for various regressions using the number of tokens sent in the Investment Game are reported in Table 4.4. In columns 1-3, we report regressions

Table 4.3: Beliefs and preferences across market exposure

	(1) TDG: tokens sent	(2) RG: switch point	(3) IG: Fraction expected
Market in village	0.0771	0.578**	-0.0236
	(0.124)	(0.258)	(0.0470)
Constant	3.826***	4.715***	1.379***
	(0.411)	(0.790)	(0.0843)
Add. Controls	Yes	Yes	Yes
N	2187	2184	2185
Adj. R-Square	0.01	0.01	0.01

* p < 0.1 ** p < 0.05 *** p < 0.01; Standard errors in parentheses, clustered at the village level; Controls include: Marital status, village size, household size, religion, number of wives, education, age, roof material and relative wealth.

Table 4.4: Determinants of sending behaviour in the Investment Game

	(1)	(2)	(3)	(4)
TDG: tokens sent	0.435***			0.427***
	(0.0256)			(0.0256)
RG: switch point		-0.00126		0.00189
		(0.0104)		(0.00904)
IG: Fraction expected			0.332***	0.225***
			(0.0823)	(0.0700)
Constant	1.659***	3.315***	2.864***	1.365***
	(0.410)	(0.361)	(0.369)	(0.414)
Add. Controls	Yes	Yes	Yes	Yes
N	2185	2181	2185	2181
Adj. R-Square	0.22	0.00	0.02	0.23

* p < 0.1 ** p < 0.05 *** p < 0.01; Standard errors in parentheses, clustered at the village level; Controls include: Marital status, village size, household size, religion, number of wives, education, age, roof material and relative wealth.

using key variables individually, while column 4 reports results for a model specification as in Equation 4.1. From columns 1-3, the most striking result is that while the number of tokens sent in the Triple Dictator Game (our indicator for altruism) explains 21% of the variation in the number of tokens sent in the Investment Game, the fraction of tokens expected in return, only explains 2%. This is our first main result: in our sample, altruism explains more of the behaviour in the Investment Game, than expectations. In neither column 2 or 4, behaviour in the risk game has a statistically significant association with the number of tokens sent. While this goes against the theoretical notion of the Investment Game as a risky decision, it is consistent with the empirical literature discussed above.

We expand the models presented in Table 4.4 to include interaction effects with the presence of markets in the village (following Equation 4.2). In the full model (Table 4.5, column 4), we find that the level effect of expectations on the amount sent is not longer significant. The full effect of expectations is driven by people in communities with markets. This result is not driven by different levels of expectations in market villages, as there is no difference between villages in this respect (Table 4.3). This is our second main result: expectations only drive sending behaviour in the Investment Game in communities with markets, not in communities without markets. We control for education, status and wealth.

A key concern in interpreting the models above, is that selection bias may be present. People who live in market towns, may have chosen to live there, rather than in remote villages. In order to address this, we match participants from market villages to participants from non-market villages using Coarsened Exact Matching (Blackwell et al., 2010). This ensures that both groups are comparable across the variables used in the matching procedure. The variables we use here are: age, religion, education, and number of wives. Tables 4.A1 and 4.A2 show balance tables before and after matching respectively. After matching, the two groups are balanced across most observables, except village-level characteristics and other personal characteristics which may be affected by markets being present. The results are presented in Table 4.6. The conclusions from Table 4.5 do not substantially change. This indicates that the results are not driven by selection effects.

4.5 Conclusion

This paper examined the role of market exposure in shaping the determinants of sending behaviour among participants of a Investment Game in Northern Cameroon. We consider three determinants: social preferences, risk preferences, and expectations.

Our two main results are as follows: (i) in our sample, altruism explains more of the sending behaviour in the Investment Game than expectations; and (ii) expectations only drive sending behaviour in the Investment Game in communities with markets, not in communities without markets.

Table 4.5: Results, full model

	(1) Altruism	(2) Risk	(3) Beliefs	(4) Full
TDG: tokens sent	0.409***			0.405***
	(0.0345)			(0.0345)
TDG x Market	0.0492			0.0425
	(0.0508)			(0.0506)
RG: switch point		0.00593		0.00910
		(0.0150)		(0.0130)
Risk x Market		-0.0131		-0.0134
		(0.0206)		(0.0183)
IG: Fraction expected			0.203	0.0721
			(0.123)	(0.111)
Expected x Market			0.220	0.261*
			(0.163)	(0.140)
Market	-0.216	0.0583	-0.245	-0.406
	(0.188)	(0.169)	(0.199)	(0.258)
Constant	1.751***	3.273***	3.028***	1.592***
	(0.407)	(0.370)	(0.363)	(0.419)
Add. Controls	Yes	Yes	Yes	Yes
N	2185	2181	2185	2181
Adj. R-Square	0.22	0.00	0.02	0.23

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$; Standard errors in parentheses, clustered at the village level; Controls include: Marital status, village size, household size, religion, number of wives, education, age, roof material and relative wealth.

Table 4.6: Results, full model, weighted

	(1) Altruism	(2) Risk	(3) Beliefs	(4) Full
Triple Dictator Game: tokens sent	0.446***			0.443***
	(10.08)			(9.76)
TDG x Market	-0.00500			-0.0133
	(-0.09)			(-0.24)
risk		-0.00907		-0.00231
		(-0.52)		(-0.17)
Risk x Market		-0.00429		-0.00634
		(-0.20)		(-0.36)
Fraction expected			0.161	0.0728
			(1.30)	(0.69)
Expected x Market			0.261*	0.227*
			(1.69)	(1.76)
Market	-0.0315	-0.0309	-0.300	-0.201
	(-0.17)	(-0.20)	(-1.58)	(-0.86)
Constant	1.708***	3.287***	3.064***	1.651***
	(11.62)	(24.06)	(19.00)	(8.67)
N	2463	2459	2541	2459
Adj. R-Square	0.22	-0.00	0.02	0.23

* p < 0.1 ** p < 0.05 *** p < 0.01; Standard errors in parentheses, clustered at the village level; Controls include: Marital status, village size, household size, religion, number of wives, education, age, roof material and relative wealth.

The first result highlights the importance of using non-standard research populations (Henrich et al., 2010). Where studies using a more "traditional" subject pool of students find that expectations explain more variation than altruism (see e.g. Ashraf et al., 2006), the fact that we find the opposite serves as a caution to use sending behaviour in the Investment Game as a proxy for trust. The second result illustrates this. Because we find that expectations matter more in communities with market exposure, and overall market exposure in our sample is lower than in other subject pools, it follows that expectations matter less in our sample than in others.

Our data does not allow us to uncover the mechanism behind this increased willingness to act on expectations found in market communities. However, we can rule out some mechanisms. For example, we find no differences in the levels of expectations and altruism between market communities and non-market communities (see table 4.3). This rules out an evolutionary mechanism as proposed by Tabellini (2008), where increased expectations and increased pro-social behaviour reinforce each other. A learning effect is more in line with our results; due to more interactions with strangers, and more interactions with a market framing, people are more willing to trust their counterparts. This could be either through increased interactions, or through increased rationality (e.g. List and Millimet, 2008; Cecchi and Bulte, 2013) is more likely. While the actual fraction returned is lower than one (and it would thus not be rational to send money), the expectations are higher than 1, meaning that respondents do expect a positive return on their amount sent.

Taken together, the results indicate that care should be taken in interpreting the behaviour in the Investment Game. Since the motivations can vary systematically with the institutional environment, sending behaviour cannot simply be used as a proxy for trust. In order to measure trust – which is an important confounder in many evaluations – data about expectations should always be collected.

4.6 Appendix

Table 4.A1: Covariate balance, before matching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All		Treatment		Control		(4)-(6)
	N	Mean	N	Mean	N	Mean	
Married	3195	0.78	1808	0.76	1387	0.80	-0.03*
		(0.42)		(0.42)		(0.40)	
Village Size	3278	173.42	1851	236.21	1427	91.97	144.24***
		(139.72)		(152.53)		(54.04)	
HH Size	3164	7.32	1784	7.42	1380	7.19	0.23
		(4.83)		(4.98)		(4.62)	
Muslim	3164	0.81	1784	0.83	1380	0.79	0.04
		(0.39)		(0.37)		(0.41)	
Number of wives	2272	1.57	1262	1.63	1010	1.49	0.14***
		(0.87)		(0.92)		(0.79)	
Village leader	3195	0.06	1808	0.06	1387	0.07	-0.01*
		(0.24)		(0.23)		(0.25)	
Head educated	3164	0.40	1784	0.42	1380	0.37	0.05
		(0.49)		(0.49)		(0.48)	
Age HH head	3164	44.54	1784	44.59	1380	44.48	0.11
		(16.09)		(15.92)		(16.31)	
Improved roof	3157	0.56	1779	0.64	1378	0.46	0.18***
		(0.50)		(0.48)		(0.50)	
High wellbeing relative to village	2633	0.18	1483	0.18	1150	0.17	0.01
		(0.38)		(0.39)		(0.38)	

Standard Deviations in parantheses; *p < 0.1,**p < 0.05,***p < 0.01

Table 4.A2: Covariate balance, after matching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All		Treatment		Control		(4)-(6)
	N	Mean	N	Mean	N	Mean	
Married	3144	0.77	1783	0.76	1361	0.78	-0.02
		(0.42)		(0.43)		(0.41)	
Village Size	3220	174.15	1825	235.46	1395	93.95	141.51***
		(139.26)		(152.42)		(55.04)	
HH Size	3108	7.44	1758	7.43	1350	7.46	-0.03
		(4.93)		(4.97)		(4.88)	
Muslim	3108	0.83	1758	0.83	1350	0.83	0.00
		(0.37)		(0.37)		(0.37)	
Number of wives	2232	1.61	1241	1.63	991	1.58	0.06
		(0.88)		(0.91)		(0.82)	
Village leader	3144	0.05	1783	0.05	1361	0.05	-0.00
		(0.23)		(0.23)		(0.23)	
Head educated	3108	0.42	1758	0.42	1350	0.42	0.00
		(0.49)		(0.49)		(0.49)	
Age HH head	3108	44.78	1758	44.84	1350	44.69	0.16
		(15.52)		(15.47)		(15.60)	
Improved roof	3103	0.57	1754	0.64	1349	0.48	0.16***
		(0.50)		(0.48)		(0.50)	
High wellbeing relative to village	2589	0.18	1460	0.18	1129	0.18	0.01
		(0.39)		(0.39)		(0.38)	

Standard Deviations in parantheses; *p $<$ 0.1,**p $<$ 0.05,***p $<$ 0.01

4.7 Bibliography

Ashraf, N., I. Bohnet, and N. Piankov (2006, sep). Decomposing trust and trustworthiness. *Experimental Economics 9*(3), 193–208.

Berg, J., J. Dickhaut, and K. McCabe (1995, jul). Trust, Reciprocity, and Social History. *Games and Economic Behavior 10*(1), 122–142.

Blackwell, M., S. Iacus, G. King, and G. Porro (2010). CEM : Coarsened Exact Matching for Stata. *The Stata Journal 9*(4), 534–546.

Bohnet, I. and Y. Baytelman (2007). Institutions and trust: Implications for preferences, beliefs and behavior. *Rationality and Society 19*(1), 99–135.

Bohnet, I., F. Greig, B. Herrmann, and R. Zeckhasuer (2008). Betrayal aversion: Evidence from Brazil, China, Oman, Switzerland, Turkey, and the United States: Comment. *American Economic Review 98*(1), 294–310.

Bohnet, I. and R. Zeckhauser (2004). Trust, risk and betrayal. *Journal of Economic Behavior and Organization 55*(4 SPEC.ISS.), 467–484.

Bouma, J., E. H. Bulte, and D. Van Soest (2008). Trust and cooperation: Social capital and community resource management. *Journal of Environmental Economics and Management 56*, 155–166.

Braga, J., S. J. Humphrey, and C. Starmer (2009). Market experience eliminates some anomalies-and creates new ones. *European Economic Review 53*(4), 401–416.

Camerer, C. (2003). *Behavioral Game Theory*. Princeton, NJ: Princeton University Press.

Cecchi, F. and E. H. Bulte (2013). Does Market Experience Promote Rational Choice ? Experimental Evidence from Rural Ethiopia. *Economic Development and Cultural Change 61*(2), 407–429.

Cox, J. C. (2004, feb). How to identify trust and reciprocity. *Games and Economic Behavior 46*(2), 260–281.

Eckel, C. C. and R. K. Wilson (2004). Is trust a risky decision? *Journal of Economic Behavior and Organization 55*(4 SPEC.ISS.), 447–465.

Fischer, J. A. V. (2008). Is competition good for trust? Cross-country evidence using micro-data. *Economics Letters 100*(1), 56–59.

Gächter, S., B. Herrmann, and C. Thöni (2004). Trust, voluntary cooperation, and socio-economic background: Survey and experimental evidence. *Journal of Economic Behavior and Organization 55*, 505–531.

Glaeser, E. L., D. I. Laibson, J. A. Scheinkman, and C. L. Soutter (2000). Measuring trust. *The Quarterly Journal of Economics 115*(3), 811–846.

Henrich, J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, R. Mcelreath, M. Alvard, A. Barr, J. Ensminger, K. Hill, F. Gil-white, M. Gurven, F. Marlowe, J. Q. Patton, and N. Smith (2005). ' Economic Man ' in Cross-cultural Perspective : Behavioral Experiments in 15 Small-scale Societies. *Behavioral and brain sciences 28*(6), 795–815.

Henrich, J., J. Ensminger, R. McElreath, A. Barr, C. Barrett, A. Bolyanatz, J. C. Cardenas, M. Gurven, E. Gwako, N. Henrich, C. Lesorogol, F. Marlowe, D. Tracer, and J. Ziker (2010). Markets, Religion, Community Size and the Evolution of Fairness and Punishment. *Science 327*(5972), 1480–1485.

Henrich, J., S. J. Heine, and A. Norenzayan (2010). Most people are not WEIRD. *Nature 466*(29), 29.

Holt, C. A. and S. K. Laury (2002). Risk Aversion and Incentive Effects. *American Economic Review 92*(5), 1644–1655.

Iacus, S. M., G. King, and G. Porro (2012). Causal inference without balance checking: Coarsened exact matching. *Political Analysis 20*(1), 1–24.

Karlan, D. S. (2005). Using experimental economics to measure social capital and predict financial decisions. *American Economic Review 95*(5), 1688–1699.

Knack, S. and P. Keefer (1997). Does Social Capital Have an Economic Payoff? A Cross-Country Investigation. *The Quarterly Journal of Economics 112*(4), 1251–1288.

List, J. A. and D. L. Millimet (2008). The Market: Catalyst for Rationality and Filter of Irrationality. *The B.E Journal of Economic Analysis & Policy 8*(1), 1935–1682.

Melesse, M. B. and F. Cecchi (2015). Market Exposure and Risk Aversion : Evidence from Landed Farm Households in Ethiopia.

Sapienza, P., A. Toldra-Simats, and L. Zingales (2013). Understanding trust. *Economic Journal 123*, 1313–1332.

Schechter, L. (2007). Traditional trust measurement and the risk confound: An experiment in rural Paraguay. *Journal of Economic Behavior and Organization 62*(2), 272–292.

Siziba, S. and E. H. Bulte (2012). Does market participation promote generalized trust? Experimental evidence from Southern Africa. *Economics Letters 117*(1), 156–160.

Sønderskov, K. M. (2011). Explaining large-N cooperation: Generalized social trust and the social exchange heuristic. *Rationality and Society 23*(1), 51–74.

Tabellini, G. (2008). The Scope of Cooperation: Values and Incentives. *The Quarterly Journal of Economics 123*(3), 905–950.

Tu, Q. and E. H. Bulte (2010). Trust, Market Participation and Economic Outcomes: Evidence from Rural China. *World Development 38*(8), 1179–1190.

Zak, P. J. and S. Knack (2001, mar). Trust and Growth. *The Economic Journal 111*(470), 295–321.

Chapter 5

Sexual violence, conflict, and female empowerment

Abstract

The high incidence rate of Sexual and Gender-based Violence in the Democratic Republic of the Congo presents a large human rights problem. Despite the attention this topic has been given, much is unclear about the drivers of SGBV, as accurate data on the subject is difficult to collect. In this paper, I explore the characteristics of the victims SGBV to uncover the dynamics and potential drivers of SGBV. I focus on conflict and female empowerment as potential drivers. In order to avoid social desirability bias and obtain reliable data on this incidence, I conducted a list experiment. I combine the data from this list experiment with rich data on respondents' households, which allows me to separate conflict into recent conflict and historic conflict; and have detailed information on the position of women within their households.

I find that 30% of the women in my sample have been victimized in the 12 months prior to the interview. The victims are likely to be married to higher-status men, have low intra-household bargaining power, and have been exposed to violent conflict to the extent where they have lost family or household members before 2012 (two years before the list experiment). These findings coincide with the view of a long-lasting impact of conflict on SGBV rates, mainly through Intimate Partner Violence (IPV). This means that human rights abuses persist long after the end of conflict. Strong measures to structurally improve the position of women in the household and society as a whole are required to address this.

This chapter is based on: Koen Leuveld. *Sexual violence, conflict, and female empowerment: Exploratory evidence from a list experiment in Eastern DR Congo* (Working Paper)

5.1 Introduction

Over the past decades, tremendous progress has been made worldwide to improve the lives of the world's poor. The proportion of people living under the poverty line of $1.25 per day dropped from over half to just 14%; gender disparity in primary education has been drastically reduced or even eliminated; under-five mortality rates have been halved (United Nations, 2015). However, such progress has largely bypassed fragile states, like the Democratic Republic of the Congo (DRC) (Asadullah and Savoia, 2018; Samy and Carment, 2011). Congolese women in particular face economic hardships and human rights violations, including a high rate of Sexual and Gender Based Violence (SGBV): estimates of the proportion of women who have suffered from this range from 15% to 40% (Johnson et al., 2010; Peterman et al., 2011). Aid workers have called the country "the world's worst place to be a woman or a child", and the UN's Special Representative on Sexual Violence in Conflict, Margot Wallström, even called the country the "rape capital of the world" (Human Rights Watch, 2009). The issue of SGBV is of specific concern, given its high psychological, social and economic costs (Post et al., 2002; Peterson et al., 2018). Consequently, tremendous international efforts have been made to implement or support projects to assist the victims of SGBV. The 2018 Nobel Peace prize was awarded to Dr. Denis Mukwege, for his work on victims of SGBV at Bukavu's Panzi Hospital.

Despite this attention, very little reliable data exists on the topic (Palermo and Peterman, 2011). Data collection efforts have been hampered by the conflicts the country has faced, which have made large-scale data collection from representative samples difficult. As a result, most data available on the topic is from surveys within clinics and NGOs aimed at assisting victims of SGBV, making comparison between victims of SGBV and non-victims difficult. These samples are obviously skewed, as they only survey women who have already come forward in search for help. Even when survey data is available, the sensitive nature of the topic may cause respondents to withhold information due their unease in discussing sensitive topics with survey field staff.

In this paper, I explore the characteristics of victims of SGBV as well as non-victims to study the dynamics and potential drivers of SGBV. I classify female survey respondents according to potential risk factors for SGBV, and analyse whether these factors are in fact associated with the incidence of SGBV. In this way, this paper aims to address the question what the drivers of SGBV in Eastern Congo are. Specifically, I consider conflict and the position of women in Congolese society as potential drivers, and compare their relative contribution.

The conflict that has persisted in the country for the past decades is the most often-cited driver of the high rate of SGBV. This is particularly true for policy circles, where the framing of SGBV in Congo as "weapon of war" is popular (Baaz Eriksson and Stern, 2013; Kirby, 2015). There is empirical evidence to

support this notion. Johnson et al. (2010) carried out a large-scale survey in Eastern Congo to investigate incidence and perpetrators of SGBV, and found that the majority of sexual violence reported by their respondents was conflict-related; of female victims of sexual violence, 74.3% reported the perpetrators to be conflict-related. Likewise, Bartels et al. (2013) find that the majority of the victims of SGBV treated at Panzi Hospital – in Bukavu, South Kivu – indicate that the perpetrators were armed groups. It is therefore not surprising that the topic of SGBV in Congo has often been analysed within the context of violent conflict (Baaz Eriksson and Stern, 2013). Conversely, the aspect of the conflict that has received the most world-wide media attention has been SGBV (Autesserre, 2012).

However, this view of the central role of conflict in sexual violence in the DRC has come under increasing scrutiny. It has been argued that this focus on the relationship between sexual violence and conflict has been counter-productive, as it has distracted attention from other pressing problems the DRC faces (Autesserre, 2012; Hilhorst and Douma, 2018; Porter, 2019). Moreover, it risks missing the civilian perpetrators of SGBV. There is empirical evidence for this position too. Based on DHS data, Peterman et al. (2011) find that rates of Sexual Intimate Partner Violence (IPV) are higher than rates of other forms of Sexual Violence in Congo.

This increased focus on IPV, rather than conflict, shifts attention from conflict to the bargaining position of women in Congolese society and households as a driver of SGBV. The bargaining position of a woman is the level of autonomy she has, and is determined by things such as her outside options; its effect on SGBV is ambiguous (Eswaran and Malhotra, 2011). One the one hand, a woman's welfare may depend on her bargaining position: women with more income, and better prospects in case of a divorce would thus face less risk of IPV. On the other hand a woman's partner may use IPV as an instrument to assert power as a response to her increased empowerment. The empirical record reflects this ambiguity. Bhattacharya et al. (2009) find that increase in employment, and the increasing of status of a woman within the household reduces violence. Similarly, Hidrobo et al. (2016) find that cash transfers to women, decrease the risk of violence. However, when specifically looking at sexual IPV in the Dominican Republic, Bueno and Henderson (2017) find that an increase in women's (economic) empowerment led to an increase in IPV. In Vietnam, (Bulte and Lensink, 2019) find that a project aiming to increase women's income, may have led to increased IPV. In Afghanistan, Gibbs et al. (2020) find no link (positive or negative) between economic empowerment and IPV. The link between IPV and women's intra-household bargaining position may be moderated by local customs, and depend on exactly the type of IPV and the type of empowerment under consideration.

These two main drivers of SGBV – conflict and empowerment – are not necessarily separate, as conflict may affect empowerment on the long run. In the short run, conflict may have a direct effect on SGBV through perpetration by armed groups, potentially in a strategic manner (Baaz Eriksson and Stern, 2013;

Kirby, 2015). This caused the topic to be on the international agenda, as a "weapon of war". However, in the long run there is a more indirect effect as well: conflict causes the breakdown of norms, which may have long-lasting effects. For example, Kelly et al. (2018) find that that IPV increased in districts that experienced conflict in Liberia, while Müller and Tranchant (2019) draw similar conclusions from data from the Gaza strip. Saile et al. (2013) investigate the correlates of IPV for a sample of conflict-exposed women in Northern Uganda. They find that while the level of conflict exposure predicts physical violence, sexual violence is more associated with the level of childhood familial violence. This link between current and past experiences of violence suggests that the effect of conflict on violence is deeper than just the direct effect. People traumatized during the conflict (either because they were victims or perpetrators) are more likely to be victimized later on.

In answering the question what the main drivers of SGBV are, I thus consider two main drivers: the position of women in Congolese society and conflict. Within conflict, I distinguish between historic conflict (here I use pre-2012 data) with long-term, indirect, effects and recent conflict (up to one year prior to the interview) with short-term, direct effects. I argue that the indirect long-term effects of conflict are likely to be related to the position of women, through changing norms, while more recent conflict events may not have had an additional impact on norms yet. For empowerment, I use a bargaining game, and survey questions that determine women's pre-marriage relative status.

This paper contributes to the empirical evidence base on the incidence of SGBV in Eastern Congo by drawing on a sample of beneficiaries of development assistance projects in South Kivu province, in the Eastern DRC. While the selection of respondents was not done to produce a representative sample for the province, it does not suffer from the same problems that clinic-based surveys have, allowing me to compare victims of SGBV with non-victims. Data on SGBV comes from a list experiment, a technique which has been gaining popularity as a way to obtain information on sensitive topics (see e.g. Sniderman et al., 1991; Holbrook and Krosnick, 2010; Bulte and Lensink, 2019; Peterman et al., 2018; LaBrie and Earleywine, 2000; Corstange, 2009). Put briefly, list experiments allow group-level analysis of SGBV victimization, without individuals revealing their own victimization status. This eliminates the need for respondents to withhold information and thus reduces the social desirability bias that results Blair and Imai (2012). Such bias may explain the fact that studies on the drivers of SGBV often contradict each other. While one study finds conflict-related perpetrators are responsible for the majority of cases of SGBV (Johnson et al., 2010), another finds intimate partners as the most common culprits (Peterman et al., 2011).Stark et al. (2017) provides an example of how different methodologies can provide different answers: when drawing on Audio Assisted Self-Interviews (ACASI) and find that intimate partners are the main perpetrators of SBV. However, in complementary group discussions, where social desirability bias is likely to be present, respondents did not bring up intimate partners at all.

I combine list experiments with detailed survey data on the household and outcomes from behavioural experiments, which allows for a rich characterization of victims of SGBV. Because such a characterization is lacking thus far, this data is useful in addressing and preventing SGBV. Moreover, while the potential drivers of SGBV mentioned above – conflict and empowerment – have been studied in isolation, this paper contributes by analysing these in one framework.

I find high victimization rates in my sample: 30% of the women report SGBV in the past twelve months. These victims are likely to be married to higher-status men, have low intra-household bargaining power, and have been exposed to violent conflict to the extent where they have lost family or household members before 2012 (two years before the list experiment). I find no evidence of a link between SGBV and recent conflict exposure. These findings are consistent with recent findings in the literature that conflict has long-lasting impact on SGBV through IPV. This paper is structured as follows: first I describe the research setting, the sample, and then the various sources of data. The subsequent section describes my empirical framework, which revolves around the use of a list experiment. I then present the results of the analyses. In the concluding section I contextualize the findings and present policy implications.

5.2 Background

Congo's 2006 constitution grants equal rights to men and women. In practice, however, women hold an inferior position in Congolese society. This is reflected in social and economic outcomes. The literacy rates among women and girls aged 15-24 is 73.6% (compared to 91.2% among men and boys of the same age); only 8.5% of women have completed secondary education (compared to 16.2% of the men); while 67% of women work, only 7.8% work outside of agriculture or trading and services (MPSMRM et al., 2014). Within the household, women occupy an inferior position as well: the husband is the head by law, and marital rape is not considered a crime (Kilonzo et al., 2009).

In addition to the difficulties inherent to their inferior position, women have faced widespread human rights abuses during the conflicts that have swept the country since the mid 1990s. South Kivu (the setting for the present study) has been greatly affected by these conflicts. The first Congo war started with an invasion by Rwanda and armed groups supported by Rwanda to clear perpetrators of the Rwanda genocide from the refugee camps in the east of the country, putting the province on the front line. Throughout this First Congo War (1996-1997), the Second Congo War (1998-2003) and the subsequent fragile peace, ethnic tensions have remained high throughout the province, resulting in frequent localized bursts of violence (see e.g. Verwijen, 2016). While some of the human rights abuses during these phases of the conflict occurred during large-scale attacks on civilians, often they occurred during ambushes while

women were conducting their day-to-day tasks (Freedman, 2011; Human Rights Watch, 2002). Women were often assaulted by multiple perpetrators. These were not only members of rebel groups, but also the government army (Human Rights Watch, 2009).

The consequences of (conflict-related) SGBV for the victims have been well-researched. It has severe mental and physical health consequences (Johnson et al., 2010). However, due to the remote nature and lack of resources, victims have difficulty finding professional help, often having to travel more than a day to clinics (Harvard Humanitarian Initiative, 2009; Kohli et al., 2012). The negative consequences persist until long after the event, as victims face stigmatization within their communities and households (Albutt et al., 2017; Harvard Humanitarian Initiative, 2009).

The adverse consequences of conflict-related SGBV do not remain limited to the direct victims. The violence against women during the conflict resulted in a change in norms, where armed groups were no longer the main perpetrators of SGBV, but civilians (including intimate partners) (Freedman, 2011). Risk factors for sexual IPV include partner problematic use of alcohol and partner controlling behaviours (Babalola et al., 2014). While the Congolese government has made attempts to address the situation, such as through the Law on the Suppression of Sexual Violence, implementation of these measures has been marred by the general lack of resources state authority in the country (Steiner et al., 2009).

5.3 Sample

The main source of data for this study is the gender module from a household survey that was undertaken in 2014 as the endline survey for the evaluation of Dutch development aid. This evaluation concerned projects ran by four NGOs in the territories of Kabare, Fizi and Uvira, and the commune of Bagira.[1] The baseline for this evaluation was done in 2012. Half of the respondents were selected from communities that benefited from the projects, the other half were selected from comparable households in non-intervention communities. These projects were about agriculture, women's rights and education. Overall, the beneficiaries of the projects were vulnerable, mostly rural, households. An indicator for being beneficiary to any of these projects is included in the full analysis below. In total data was collected in 73 communities. In each community, baseline data was collected on 15 households in 2012; however, due to attrition, 2014 data is available for an average of 12 households per community, for a total of 889 households.

The sampling procedure outlined here is thus unlikely to have produced a nationally (ore even provincially) representative sample. In Table 5.1, I present a comparison across selected demographics between the full study sample (column 3), and the representative sample from the DHS Program (columns 1-2).

[1] In the remainder of the paper, I will consider Kabare and Bagira to be one "territory", since the selected communities in Kabare and Bagira are located close together, in the peri-urban zone of Bukavu.

Table 5.1: Comparison of DHS and sample data

	DHS National mean	DHS South Kivu mean	Full Sample mean	Gender Module mean
Age of FR	31.83	31.09	40.58	41.09
Household has a tin roof	0.33	0.60	0.58	0.61
FR completed primary education	0.47	0.29	0.25	0.25
FR completed secondary education	0.10	0.06	0.02	0.03

FR = Female respondent. DHS = Demographic Health Survey (MPSMRM et al., 2014). For the DHS data, means are provided for household members satisfying the same criteria as FRs from the sample: female heads of household, or female spouses of household heads.

Table 5.2: Gender module sample make up

	Male Respondent				
Female Respondent	Consented No.	Refused No.	Absent No.	No Husband No.	Total No.
Consented	184	3	253	153	593
Refused	0	0	0	1	1
Absent	4	0	0	1	5
No Wife	282	3	2	3	290
Total	470	6	255	158	889

Women in the study sample are older, and less likely to have finished school, than the provincial average in South Kivu.

Not all households participated fully in the gender module. Where possible, it was administered to both the head of the household and their spouse, so that there were a Female and a Male Respondent to the interview [2]. In the vast majority of the cases, the husband is considered the head, but it was left open to the respondents to indicate the head. Table 5.2 displays how the sample is built up. In total, there were 889 respondents to the survey. In 593 households, the Female Respondent (the wife of the household head or the female head) consented to responding to the gender module. In 1 household, the female respondent refused; in 5, the Female Respondent was absent during the interview, and in 290 households the head of the household had no wife, and there was thus no Female Respondent. In 470 households, the Male Respondent (usually the household head) consented to the module, 6 refused, 255 Male Respondents were absent, and in 158 households the head of the household was an unmarried woman, meaning that there was no Male Respondent. In 184 households, both husband and wife responded to the module. Efforts to increase this number, by tracking down absent household heads, were constricted by the limited time field teams had in each community due to the security situation at the time of field work. As a consequence of this, sample sizes between various analyses are different: analyses relying on both partners being present - e.g. for the bargaining game - will have a lower sample size than others.

The selection of respondents to the gender module is unlikely to have been random. In column 4 of

[2] In tables, I refer to Male and Female Respondents as MR and FR respectively.

Table 5.1 selected demographics for the Female Respondents to the gender module are presented. The respondents are slightly older than the full sample, and considerably older than the provincial average. They are slightly more likely to have completed secondary school than the full sample, but less likely than the provincial average. In Table 5.A1, I present results from logit models to find correlations between household characteristics and participation in the gender module. The dependent columns of the columns are whether the wife, the husband and the couple participated in the gender module, respectively. There are some selection effects. Households that own tin roofs, are more likely to have a Female Respondent. In households that own livestock, it was less likely that there was a female respondent to the gender module, and more likely to have male respondent. The final analysis below will include these as controls.

5.4 Methods

This paper combines data from the 2014 and 2012 rounds of the survey, with ACLED data. The gender module from the 2014 survey is the main source of data for this paper. The module was administered separately to Male and Female Respondent (with a small part being administered jointly). It contained (i) a list experiment designed to elicit the incidence of SGBV among Female Respondents; (ii) a risk bargaining game to elicit the relative intra-household bargaining position of the Male and Female Respondent; and (iii) a set of propositions to collect detailed information on gender attitudes. I present the List Experiment, and the analysis thereof, in more detail in the Empirical Framework below.

Table 5.3: Bargaining game lotteries

#	Low	High	Expected	Risk aversion
1	4,000 CDF	4,000 CDF	4,000 CDF	Extremely risk-averse
2	3,600 CDF	4,800 CDF	4,200 CDF	Extremely risk-averse
3	3,200 CDF	5,600 CDF	4,400 CDF	Moderately risk-averse
4	2,800 CDF	6,400 CDF	4,600 CDF	Moderately risk-averse
5	2,400 CDF	7,200 CDF	4,800 CDF	Risk-neutral
6	1,400 CDF	8,200 CDF	4,800 CDF	Risk-loving

The risk bargaining game in the gender module was modified from Martinsson et al. (2009). In the game, the respondents chose between a set of six risky lotteries, based on Eckel and Grossman (2002). The lotteries presented ranged from fairly low-risk ones – where low and high pay-out were nearly equal – to high-risk one – where there was a large difference between high and low pay-outs (see Table 5.3 for details of the lotteries). The Male and Female Respondents first chose privately (without knowing their partner's choice), and then jointly. By comparing the couple decision with the individual decision, I obtain an indicator for bargaining power: the closer the couple decision is to the Female Respondent's decision – relative to the Male Respondent's decision – the higher her bargaining power. The difference between

the procedure used by Martinsson et al. (2009) and the one here, is that they use a risk experiment based on Holt and Laury (2002); a more complicated experiment compared to Eckel and Grossman. This added complication may cause some participants to not fully understand the procedure, leading to poor results (Dave et al., 2010). Given the low numeracy of the subjects, I implemented the simpler of the two experiments.

I draw on two sources for conflict data: data from the 2012 round of the survey, and ACLED data from 2013-2014. The 2012 data contains detailed information of the conflict history of the respondents dating back to the start of the First Congo War in 1996. Among other things, respondents were asked whether they lost family members, whether they lost property, and when these events took place. I use this to construct indicators for historic victimization, which may have indirect effects on SGBV victimization. Due to time constraints, the 2014 round of the survey did not contain a detailed conflict exposure module. In order to get more detailed information on recent victimization, complement the household-level data with more recent data from the Armed Conflict Location & Event Data Project (ACLED; Raleigh et al., 2010). The 2014 data contains GPS coordinates for all interviewed households. Using these coordinates, I can link households to nearby conflict events from the ACLED database that took place within the 12 months preceding the interview. Because this data then coincides with the window for SGBV used here, any direct effects from conflict – like perpetration of SGBV by armed groups – will be captured by this indicator. However, while this data is more recent, it does not capture individual experience; only exposure based on the distance from the household to conflict events.

5.5 Empirical Strategy

A major concern in collecting data on SGBV is reporting bias. Respondents are unlikely to be comfortable to truthfully answer questions about SGBV. Respondents may want to hide undesirable answers, leading to what's called social desirability bias. Not only may this lead to an underestimate of the incidence of SGBV, the unwillingness to divulge information may be correlated to the identity of the perpetrators: people may be more willing to divulge victimization from armed groups, than from intimate partners (Stark et al., 2017). This non-random nature of non-response would thus lead to an underestimate of the incidence of SGBV, and biased estimates for the correlates of SGBV when using direct questions. This is why such direct questions are not used in list experiments. Instead, interviewers present respondents with a list of issues and ask them to indicate the number of issues from the list they have faced. By adding the sensitive item to the list of issues for half of the respondents (randomly selected), estimates for incidence of the sensitive item can be obtained by comparing the mean number of issues faced in both groups (hence "item count technique" as an alternative name for list experiments). The advantage is thus

that answers are guaranteed to be anonymous: the interviewer (or the data analyst) does not know the number of non-sensitive issues the respondent faces and so has no way of knowing the answer to sensitive item. This anonymity removes the need to hide the answer, and thus the social desirability bias.

Over the past decades, list experiments have grown in popularity as a way to obtain accurate data on sensitive topics. Holbrook and Krosnick (2010) review 48 studies using list experiments, and found that they are effective at decreasing social desirability bias. Comparing studies that use list experiments with studies that do not, they find that reporting rates of sensitive items are higher in studies using list experiments. It is therefore not surprising that this approach has been applied to a wide range of topics, such as sensitive political opinions (Frye et al., 2017; Blair et al., 2014; Meng et al., 2017; Corstange, 2009), over-reporting of voting (Holbrook and Krosnick, 2010), risky behaviours (LaBrie and Earleywine, 2000) and SGBV (Bulte and Lensink, 2019; Peterman et al., 2018).

For the list experiment in this study, the female respondents were randomly divided into two groups. This was done by the electronic survey software (ODK), based on the randomly assigned ID codes. I follow Imai (2011) in calling these groups Treatment and Control. An interviewer told each respondent: "I will read 4 *(or 5)* problems that women can experience. These can be sensitive problems. When you've experienced a problem in the last year, please drop one of the balls to the ground. I will not look at when you drop these balls, and only want to know the total number of balls at the end. In the past 12 months, did you experience...

- Lack of food;
- Lack of money;
- Theft;
- Sterility; and,
- Sexual Violence (Treatment group only)"

The interviewer only presented women randomly selected to be in the treatment group with the fifth item (Sexual Violence). I selected the four control items in such a way that it is unlikely women in the sample face none, or all, of the issues. In such cases the interviewer knows the respondent's answer to the sensitive issue ("no" if the total number of issues is 0, "yes" if the total number is 5). Not all the control items are non-sensitive, as the item "sterility" is a sensitive item. This was done to reduce respondent suspicion when one sensitive items is juxtaposed with a number of completely non-sensitive items (see Chuang et al. (2019) for a more detailed explanation). After all items were read, the interviewer asked the respondent to count the number of balls, and report the number. The questionnaire was field tested prior to field work to ensure that respondents understood these concepts. All interviewers were thoroughly trained in the protocols, and the electronic questionnaire was programmed in such a way to ensure compliance to the protocol.

A crucial assumption for the list experiment is that the randomization ensures that Treatment and Control groups are identical. Table 5.4 (Column 7) provides a comparison of the two groups within the sample. The treatment and control group are not perfectly balanced across some of the variables. However, an F-test on the differences between treatment and control being jointly equal to zero fails to reject the null-hypothesis that they are equal (p=0.20). This suggests that the differences found are due to chance, rather than any bias in the randomization procedure.

While the indirect nature of list experiments prevents reporting bias, this does come at a cost of efficiency in statistical analysis. The incidence is easily computed by subtracting the mean of issues faced in the control group from the mean number of issues in the treatment group. This means that sample sizes have to be far larger for list experiments than for direct questions.

In a regression framework, the incidence would be estimated as follows (Holbrook and Krosnick, 2010):

$$NumIssues_i = \beta_0 + \beta_1 Treatment_i + \epsilon_i \tag{5.1}$$

Where $NumIssues_i$ is the number of issues experienced by respondent i, and $Treatment_i$ is her treatment assignment. Coefficient β_1 yields the estimate for the incidence. To find correlates of SGBV, equation 5.1 can be augmented using interaction terms as follows:

$$NumIssues_i = \beta_0 + \beta_1 Treatment_i + \beta_2 X_i + \beta_3 Treatment_i X_i + \epsilon_i \tag{5.2}$$

Where X_i is an explanatory variable and coefficient β_3 gives the estimate for the additional incidence of SGBV associated with a unit increase of X. This can be easily modified to allow for more variables. Again, this is much less efficient than when using direct questioning. By using more sophisticated methods proposed by Imai (2011) (and implemented by Tsai (2019) in Stata), more efficient estimates can be obtained.

5.6 Results

In this section, I will first compare the results of the list experiment in the whole sample, then in different sub-groups. I then present results from a full multivariate regression that aims to minimize potential bias caused by confounding variables.

In the full sample, the difference between the group who were presented with only four issues (the Control group) and the group who were presented four issues plus SGBV (the Treatment group) is the estimate of the incidence of SGBV. The average number of issues reported by the control group is 2.34, while the number if issues reported by the treatment group is 2.65 (see Figure 5.1). The difference of

Table 5.4: Descriptive statistics by treatment assignemt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All		Treatment		Control		(4)-(6)
	N	Mean	N	Mean	N	Mean	
Number of reported issues	593	2.49	291	2.65	302	2.34	0.30***
		(0.94)		(1.03)		(0.83)	
Conflict pre-2012: property lost	530	0.77	264	0.79	266	0.75	0.04
		(0.42)		(0.41)		(0.43)	
Conflict pre-2012: HH member killed	530	0.49	264	0.51	266	0.48	0.03
		(0.50)		(0.50)		(0.50)	
Conflict 2013–2014: Viol. against civilians	496	6.73	239	6.68	257	6.77	–0.08
		(4.69)		(4.70)		(4.69)	
Family MR had more land	450	0.33	224	0.33	226	0.33	–0.00
		(0.47)		(0.47)		(0.47)	
Family FR had more land	450	0.21	224	0.22	226	0.19	0.02
		(0.41)		(0.41)		(0.40)	
Bargaining: choice Female Respondent	593	3.58	291	3.59	302	3.56	0.04
		(2.06)		(2.08)		(2.05)	
Barganing: choice Male Respondent	184	3.45	97	3.49	87	3.40	0.09
		(2.14)		(2.12)		(2.18)	
Bargaining: closer to MR	184	0.40	97	0.37	87	0.44	–0.07
		(0.49)		(0.49)		(0.50)	
Bargaining: closer to FR	184	0.27	97	0.32	87	0.21	0.11*
		(0.44)		(0.47)		(0.41)	
Age of FR	593	41.09	291	40.49	302	41.67	–1.17
		(14.01)		(14.06)		(13.96)	
Age of MR	449	45.67	224	44.48	225	46.85	–2.37**
		(13.80)		(13.09)		(14.40)	
HH Head Female	593	0.26	291	0.24	302	0.27	–0.03
		(0.44)		(0.43)		(0.45)	
FR completed primary education	593	0.25	291	0.26	302	0.25	0.01
		(0.44)		(0.44)		(0.43)	
FR completed secondary education	593	0.03	291	0.02	302	0.04	–0.02
		(0.17)		(0.13)		(0.20)	
MR completed primary education	449	0.63	224	0.63	225	0.63	0.01
		(0.48)		(0.48)		(0.48)	
MR completed secondary education	449	0.20	224	0.19	225	0.20	–0.01
		(0.40)		(0.39)		(0.40)	
Household has a tin roof	593	0.61	291	0.62	302	0.59	0.03
		(0.49)		(0.49)		(0.49)	
Household owns livestock	593	0.49	291	0.51	302	0.47	0.03
		(0.50)		(0.50)		(0.50)	
territory==Uvira	593	0.24	291	0.24	302	0.23	0.01
		(0.43)		(0.43)		(0.42)	
territory==Fizi	593	0.63	291	0.65	302	0.62	0.03
		(0.48)		(0.48)		(0.49)	
Project Beneficary	593	0.50	291	0.49	302	0.50	–0.01
		(0.50)		(0.50)		(0.50)	

FR = Female Respondent; MR = Male Respondent; Standard Deviations in parentheses; *p < 0.1,**p < 0.05,***p < 0.01

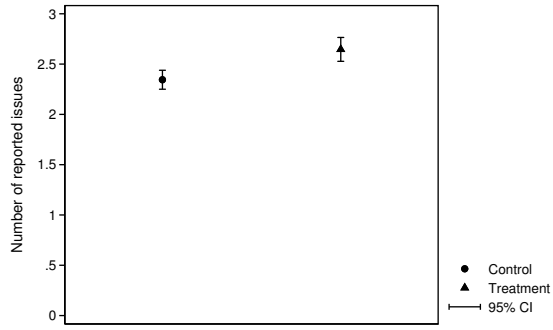


Figure 5.1: Comparison of means of issues faced: treatment vs. control.

0.30 implies that the incidence of SGBV is 30% in this sample. The p-value for a t-test on this difference is 0.000. This estimate appears substantially higher than previous estimates. These previous estimates (e.g. Peterson et al., 2018; Stark et al., 2017; Johnson et al., 2010) arrive at a similar rate of victimization, but over the life of the respondent, whereas here we only consider victimization the past twelve months. A higher incidence is expected, since the sample is non random, drawing mostly from vulnerable rural households.

5.6.1 Conflict

With respect to conflict, I distinguish between recent conflict (as indicated by ACLED events that happened within the 12 months before the list experiment) and historic conflict (1996-2012). Historic conflict can only have had an indirect effect on SGBV, e.g. through changed norms, as the list experiment only covers SGBV events within the past 12 months. Recent conflict can have a direct effect through perpetration during the conflict event.

I first analyse victimization patterns by comparing sub-groups of the respondents, based on one variable at a time. A full, multivariate analysis will follow. With respect to conflict, I consider three ways of splitting the sample in sub-groups: (i) respondents who live in households that indicated (or not) in 2012 to have suffered loss of (or damage to) property, including agricultural fields, due to conflict; (ii) whether the respondent's household indicated in 2012 to have lost any household members or family as a consequence of the conflict (or not); and (iii) whether number of instances of violence against civilians in ACLED data within a 10km radius during the past twelve months was higher than the number of instances for the median household (nor not) [3].

[3]The results presented here are robust to using number of battles or number of fatalities rather than the instances of

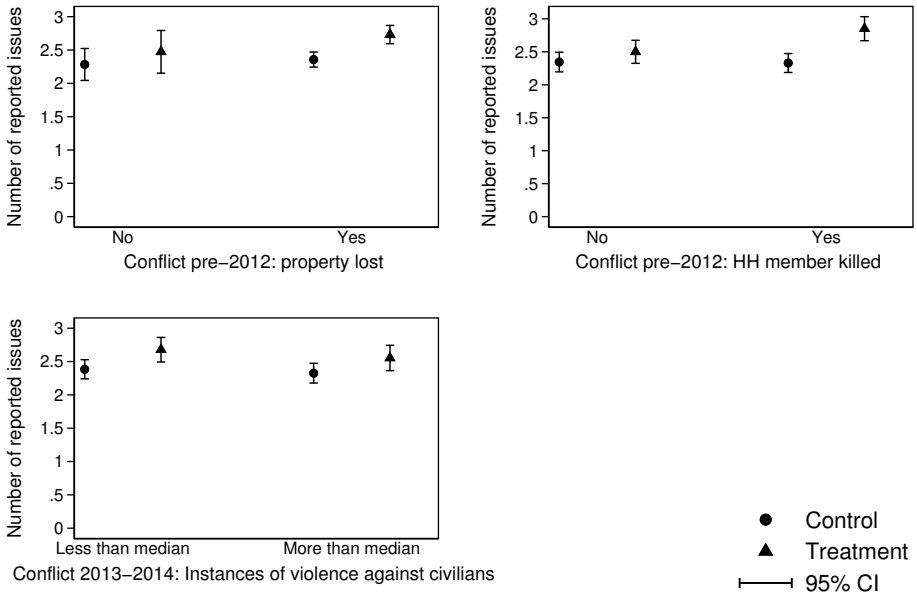


Figure 5.2: Comparison of means of issues faced across conflict exposure.

Conflict exposure was high in the sample (see Table 5.4): 77% of the respondents reported having lost property due to conflict between 1996 and 2012. 49% of the respondents reported the loss of a family or household member. Again, conflict exposure was high, even when limiting the time-span to one year prior to the data collection. The mean number of violent conflicts within a 10km radius was 6.73. This exposure differs across the territories (Table 5.5). While respondents in all territories were greatly affected by conflict prior to 2012, those in Fizi were hit harder. In the 12 months before the survey however, Uvira was in the midst in an outbreak of violence, related to conflicts surrounding the succession of traditional rulers in the chefferies of Bafuliiro and Plaine de la Ruzizi. In fact, weeks before data collection in 2014 took place, 30 civilians were killed in Mutarule, a village in the Plaine, but not in my sample. This difference in recent and historic conflict patterns means that households with conflict exposure pre-2012 are not more likely to be victimized in 2013-2014 (see also Table 5.A2). Associations between pre-2012 violence and SGBV will thus not be the result of re-targeting of the same households.

The results of the sub-group analysis is displayed graphically in Figure 5.2. From the top two panels, it can be seen that the difference between treatment and control is greater among conflict-victimized respondents than among non-conflict victimized respondents. The size of these differences is listed in

violence against civilians; using 5,15,20, 25 or 30km as a radius; and using a continuous variable, rather than a binary variable.

Table 5.5: Conflict exposure by territory

	Kabare/Bagira	Uvira	Fizi	Total
Conflict pre-2012: property lost	0.440	0.700	0.847	0.770
	(0.501)	(0.460)	(0.360)	(0.421)
Conflict pre-2012: HH member killed	0.120	0.393	0.588	0.492
	(0.328)	(0.490)	(0.493)	(0.500)
Conflict 2013-2014: Viol. against civilians	7.289	10.05	4.892	6.726
	(1.797)	(2.752)	(5.052)	(4.689)

Table 5.6. Among those that indicated not having lost property, the difference in number of issues faced between treatment and control is 0.19, implying a SGBV victimization rate of 19%. The difference between Treatment and Control among respondents who did lose property was 0.38. The difference in the differences between these groups of 0.19 issues (this corresponds to coefficient β_3 in equation 5.2 above) is not statistically significant. When splitting the sample by households indicating having lost a family or household member to conflict before 2012, the difference-in-difference estimate is 0.37, indicating that incidence of SGBV among respondents who lost family due to conflict is 37 percentage points higher than among those who have not. This effect is significant at the 5% level. Note that the SGBV could not have happened during the same time as the conflict event(s): the SGBV happened twelve months before the interview in 2014, while the conflict events happened before 2012.

When looking at more recent exposure to conflict, no clear patterns emerge (see bottom panel of Figure 5.2). SGBV incidence among women who have more instances of violence near them than the median is 7 percentage points lower than women who do not (bottom row of Table 5.6). However, this is not statistically significant. I thus find no evidence of large-scale direct perpetration of SGBV by armed groups in the one year before data collection, but also no evidence of indirect effects of recent conflict.

The fact that conflict before 2012 correlates with SGBV, but recent conflict does not, points at a more complex relationship between conflict and SGBV than a simple direct effect due to perpetration by armed groups. It is more likely that violence has an indirect effect through changed norms. The fact that recent conflict seems not to have an indirect effect either, may mean that this change of norms takes time, or that the nature of recent conflict is different from historic conflict.

5.6.2 Intra-household bargaining position

I then create sub-groups based on the intra-household bargaining position of the respondents. I compare women across two variables. First, I compare women across the relative status of the partners at the time of marriage, by using family land-holdings as a proxy for status. The 2014 survey contained a section on

Table 5.6: Differences in numbers of issued faced in the list experiment, across conflict indicators

Variable	N	Control	Treatment	Diff	St. Err.
Conflict pre-2012: property lost					
No	122	2.28	2.47	0.19	0.200
Yes	408	2.36	2.73	0.38***	0.090
Diff in Diff				0.19	0.218
Conflict pre-2012: HH member killed					
No	269	2.35	2.50	0.15	0.116
Yes	261	2.33	2.85	0.52***	0.117
Diff in Diff				0.37**	0.165
Conflict 2013-2014: Instances of violence against civilians					
Less than median	243	2.38	2.68	0.29**	0.118
More than median	253	2.33	2.55	0.23*	0.122
Diff in Diff				-0.07	0.170

Robust Standard errors reported.
* p < 0.1, **, p < 0.05, *** p < 0.01

the marriage of the (spouse of the) household head. In this section, respondents were asked whose family owned more land, prior to the marriage: the wife's, the husband's, or whether they had equal land. This choice of proxy was made in consultation with local partners (including NGOs and universities), and based on the importance of agriculture in the area. In 33% of the cases, the husband's family had more land, in 21% of the cases the wife's family did. Note that only 450 households responded to this question, as some refused to give a definite answer (Table 5.4).

The second intra-household aspect I explore is derived from the results of the bargaining game played with couples during the 2014 survey. I create three groups, based on whether the joint decision is closer to the husband's decision, to the wife's, or if the distance is equal. The mean choice of the Female Respondents in the sample was 3.58; the Male Respondents were slightly more risk-averse: their mean choice was 3.45. In 40% of the cases, the couple decision was closest to the Male Respondent's choice. In 27% it was closer to the Female Respondent's. Note that the size of the sample here is smaller than for the other variables presented, as it was not always possible to have both the Male and Female Respondent present at the same time for the interview.

Figure 5.3 displays the results from the sub-group analysis. Overall, the difference between treatment and control is larger for the sub-groups of respondents with a worse intra-household bargaining position, indicating that the incidence of SGBV is higher among these respondents. As suggested by the large size of the 95% confidence intervals, some of these sub-groups are small. In Table 5.7, these differences are tabulated, including the sizes of the sub-groups. However, the variable definitions are slightly different, due to the difficulties in interpreting difference-in-differences between three sub-groups. For each variable, two comparisons are tabulated: one, comparing households where the female respondents had the better bargaining position with the two other sub-groups, and one comparing households where the

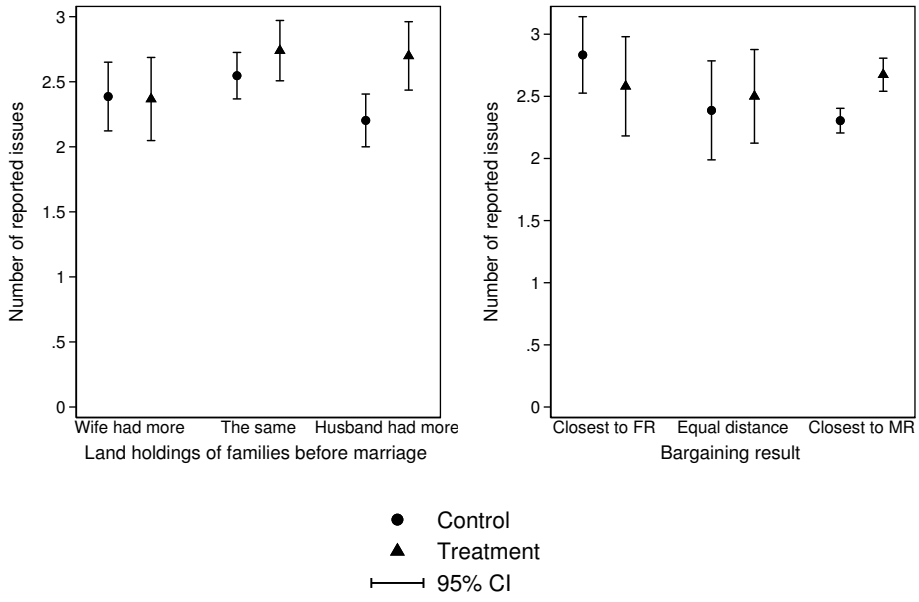


Figure 5.3: Comparison of means of issues faced by pre-marriage status.

male respondent had the better bargaining position with the two other sub-groups. Female respondent in households where the family of the husband had the most land prior to marriage were victims of SGBV in 50% of the cases, while 16% of the other respondents were. The difference of 33 percentage points is statistically significant at the 10% level. In the other comparison for the same variable, the difference is even larger, but not statistically significant; perhaps due to the low number of women with more pre-marital status than their husbands. The differences when split by results from the bargaining game are larger still: 57 or 61 percentage points, depending on the groups used.

While these results may suggest that IPV is an important driver of SGBV, the fact that I have no information on perpetrators means that this is not certain.

5.6.3 Multivariate Regression analysis

In the preceding sections, I examined univariate relations between variables of interest and the incidence of SGBV. However, such analysis may suffer from omitted variables and spurious correlations. Here I move to a richer specification, in order to prevent such biases, and assess the relative importance of each driver. I expand equation 5.2 to simultaneously include indicators for conflict and intra-household bargaining position. To reduce the risk of multi-collinearity, I do not include the full set of variables

Table 5.7: Differences in numbers of issued faced in the list experiment, across intra-household status

Variable	N	Control	Treatment	Diff	St. Err.
Family MR had more land					
No	303	2.45	2.61	0.16	0.105
Yes	147	2.20	2.70	0.50***	0.167
Diff in Diff				0.33*	0.197
Family FR had more land					
No	357	2.36	2.71	0.35***	0.099
Yes	93	2.39	2.37	-0.02	0.206
Diff in Diff				-0.37	0.227
Bargaining: closer to MR					
No	110	2.55	2.54	-0.01	0.191
Yes	74	2.16	2.72	0.56***	0.210
Diff in Diff				0.57**	0.284
Bargaining: closer to FR					
No	135	2.26	2.62	0.36**	0.167
Yes	49	2.83	2.58	-0.25	0.244
Diff in Diff				-0.61**	0.294

Robust Standard errors reported.
* p < 0.1, **, p < 0.05, *** p < 0.01

discussed above, but select one indicator for each, guided by the results obtained above. A key criterion for selection is the number of respondents for each indicator. The analysis of list experiments suffers from rapid loss of power due to the indirect nature of the analysis. To mitigate this, indicators that are available for large groups of respondents were selected. For conflict, I include both the indicator for household member killed before 2012 (as an indicator for historic conflict) and violence against civilians from the ACLED data (as an indicator for recent conflict); and for intra-household bargaining position a dummy for the husband's family having the most land. I use the KICT Stata package developed by Tsai (2019) to estimate these models. Interpretation of the coefficients is the same as equation 5.2, but estimation is more efficient.

In order to reduce missing variable bias, I include a set of controls that likely (co-) determine SGBV and the right-hand side variables listed above. A full analysis of these determinants is provided in the Appendix, Table 5.A2. In addition, I include variables that determine sample selection, as displayed in Table 5.A1. In particular, I include the age of the Female Respondent; indicators for the education of the Male and Female respondents; asset holdings of the household, including livestock and a tin roof; territory dummies; and an indicator for being in the treatment group of any of the projects under evaluation for the survey.

In Table 5.8 I display the results of these regressions. In columns 1-3 I rerun the univariate models from above. Results are the same as before: both conflict history and intra-household bargaining are associated with increased incidence of SGBV. I In column 4 I present the full model. I find that women in a marriage where their husband's family had more land before the marriage, are 45 percentage points

more likely than other women to be victim of SGBV. Note that the pre-marriage status of women within the household is uncorrelated to conflict (see Table 5.A2). Women who live in households that lost a family or household member due to conflict prior to 2012 are 37 percentage points more likely to be victimized by SGBV than other women. Of note is also the negative associated of the Female Respondent having a secondary education: in this linear model, women with secondary education are 125 percentage points less likely to be victimized. The fact that the absolute value of this coefficient is higher than 1 is due to the fact that linear models do not constrain predictions of probabilities between 0 and 1.

The finding that conflict history is associated with an increase in SGBV, while recent conflict is not, points to the indirect relationship between conflict and SGBV, where conflict may affect SGBV rates not through perpetration by armed groups, but by an increase in IPV. The notion that IPV is a major driver of SGBV is reinforced by the fact that both intra-household bargaining position and secondary education are negatively associated with SGBV. This suggests that the position of women is important in protecting them from human rights violations.

Caution should be taken with this interpretation, as results presented here are not necessarily causal: women with higher education may differ from other women in non-observable ways, and face lower victimization because of that, rather than education. Furthermore, no data exists on the perpetrators of the violence. The method of a list experiment does not allow for follow-up questions to victimized women, as the interviewer cannot know who to ask these follow up questions to.

5.7 Conclusion

In this paper, I analysed the results from a list experiment, in order to identify potential drivers of SGBV in Eastern Congo. Prevalence of SGBV is high in Congo, however little is known about the victims, and the drivers of victimization. In order to address this, I combined the results from the list experiment with rich data, including a household survey, a bargaining game, and conflict data.

The incidence rates I find are very high: 30% of the women in the sample report having been the victim of SGBV in the past twelve months. Most data collected on lifetime victimization arrives at similar rates, suggesting that this estimate for a one-year window is high. The rate found here may thus not be nationally, or regionally, representative. This is likely due to the fact that women in the sample were recruited among beneficiaries and potential beneficiaries of programs aimed at assisting the most vulnerable women and households. It is to be expected that incidence rates in this group are higher than for other groups. In fact, I find that secondary schooling rates among women in my sample is lower than the national or provincial average, and that incidence of SGBV among women who have attended secondary school are significantly lower than among other women.

Table 5.8: Multivariate regression Results

	(1)	(2)	(3)	(4)
Family MR had more land	0.419**			0.451*
	(0.204)			(0.240)
Conflict pre-2012: HH member killed		0.409**		0.374**
		(0.182)		(0.179)
Conflict 2013-2014: Viol. against civilians			0.0120	0.0147
			(0.0224)	(0.0230)
FR empowerment attitudes				0.000101
				(0.0199)
Age of FR	0.00843	0.00684	0.00563	0.0110
	(0.0161)	(0.0182)	(0.0186)	(0.0207)
Age of MR	-0.0122	-0.00929	-0.00778	-0.0111
	(0.0149)	(0.0162)	(0.0174)	(0.0189)
HH Head Female	0.00951	-0.0766	0.257	0.421
	(0.445)	(0.525)	(0.318)	(0.410)
FR completed secondary education	-1.111***	-1.347***	-1.034***	-1.249***
	(0.320)	(0.351)	(0.336)	(0.332)
MR completed primary education	-0.0390	-0.0655	-0.193	-0.263
	(0.166)	(0.178)	(0.181)	(0.177)
Household has a tin roof	0.292	0.279	0.184	0.214
	(0.203)	(0.221)	(0.234)	(0.233)
Household owns livestock	-0.0455	-0.00342	-0.142	-0.193
	(0.160)	(0.181)	(0.177)	(0.186)
territory==Uvira	0.418	0.202	0.438	0.205
	(0.264)	(0.342)	(0.288)	(0.360)
territory==Fizi	0.511*	0.232	0.504*	0.191
	(0.292)	(0.365)	(0.302)	(0.379)
Project Beneficary	0.0542	0.0121	0.0382	0.0732
	(0.163)	(0.177)	(0.157)	(0.167)
Constant	-0.162	-0.00267	-0.00290	-0.111
	(0.483)	(0.506)	(0.491)	(0.614)
Observations	449	402	379	350

FR = Male Respondent; MR = Female Respondent
Standard errors clustered at the village level; * $p < 0.1$, **, $p < 0.05$, *** $p < 0.01$

When examining the backgrounds of the victims, I find that they are likely to be married to higher-status men, have low intra-household bargaining power, and have been exposed to violent conflict to the extent where they have lost family or household members before 2012 (two years before the list experiment). When comparing these effects in one analysis, I find that the effect of intra-household dynamics is larger than the effect of conflict. This contrasts with popular frames where the conflict is seen as the primary driver of SGBV, but is in line with previous literature suggesting that intimate partners are more likely perpetrators of SGBV than members of armed groups (see e.g. Peterman et al., 2011).

Taken together, these finding imply that human rights violations do not end when the conflict ends. The disruption of social norms may cause women (and perhaps men, but the present data set does not cover them) to suffer from violence long after the last shot has been fired. A focus of rape as a "weapon of war" may thus be too narrow to address these violations. This is not to say there direct perpetration of SGBV by armed forces is not a problem in Congo. There is ample proof that large-scale violations have been committed by armed forces, especially historically. The conflict has undergone changes throughout the years, and with it the kinds of human rights violations perpetrated. The massacre in Mutarule in the weeks before data collections did see 30 innocent civilians murdered, but there are no reports of rape. Furthermore, focusing efforts to assist women on the victims from such attacks risks missing women victimized in their homes, far away from any fighting. Structural changes encouraging women's education and tangibly raising their status are needed to protect these women as well.

There are three large caveats with these findings: (i) causal interpretation is difficult due to the cross-sectional nature of the data; (ii) little analysis could be done on the perpetrators of the violence, as indirect questioning precludes probing into this. More research is needed to to address these important issues; and (iii) I did not collect data on the victimization of men. More research is needed to address these.

5.8 Appendix

Table 5.A1: Sample selection for the Gender Module

	(1) Wife	(2) Husband	(3) Couple
Age of FR	-0.0305**	0.0244**	-0.0124
	(0.0126)	(0.0112)	(0.0127)
Age of MR	0.0199*	-0.00864	0.0176
	(0.0118)	(0.0110)	(0.0130)
HH Head Female	0.171	-1.142*	
	(0.689)	(0.602)	
FR completed primary education	0.120	-0.197	-0.109
	(0.224)	(0.245)	(0.210)
FR completed secondary education	0.484	-0.285	0.169
	(0.587)	(0.399)	(0.488)
MR completed primary education	-0.0233	0.226	0.279
	(0.189)	(0.218)	(0.230)
MR completed secondary education	0.228	-0.208	-0.00740
	(0.213)	(0.215)	(0.212)
Household has a tin roof	0.307*	0.0468	0.446**
	(0.181)	(0.171)	(0.207)
Household owns livestock	-0.564***	0.695***	0.146
	(0.204)	(0.189)	(0.172)
territory==Uvira	-0.215	1.165***	0.949***
	(0.297)	(0.261)	(0.336)
territory==Fizi	-0.0496	0.312	0.258
	(0.263)	(0.217)	(0.296)
Project Beneficary	0.490**	-0.450**	0.0594
	(0.195)	(0.182)	(0.249)
Constant	0.726*	-0.700	-2.347***
	(0.430)	(0.434)	(0.429)
Observations	717	717	704

Standard errors clustered at the village level
* p < 0.1, **, p < 0.05, *** p < 0.01

Table 5.A2: Determinants of Violence and Bargaining Power

	(1) Family MR had more land	(2) Bargaining: closer to FR	(3) Conflict pre-2012: HH member killed
Family MR had more land		0.0756	0.679
		(0.0554)	(0.476)
Conflict pre-2012: HH member killed	0.0799		-1.494***
	(0.0588)		(0.476)
Conflict 2013-2014: Viol. against civilians	0.00885	-0.0184***	
	(0.00627)	(0.00477)	
Age of FR	-0.00431	0.00219	-0.0264
	(0.00602)	(0.00448)	(0.0349)
Age of MR	0.00355	-0.00146	0.0281
	(0.00435)	(0.00390)	(0.0320)
FR completed primary education	0.0542	-0.109	-0.0536
	(0.0695)	(0.0656)	(0.672)
FR completed secondary education	-0.0147	0.474***	0.602
	(0.129)	(0.147)	(1.417)
MR completed primary education	0.0834	0.0314	-0.347
	(0.0612)	(0.0622)	(0.512)
MR completed secondary education	-0.0523	0.0408	0.239
	(0.0703)	(0.0764)	(0.603)
Household has a tin roof	-0.0267	-0.114**	0.563
	(0.0537)	(0.0509)	(0.539)
Household owns livestock	0.114**	0.0536	-0.235
	(0.0554)	(0.0526)	(0.490)
territory==Uvira	-0.0556	0.295***	3.566***
	(0.0589)	(0.0904)	(1.104)
territory==Fizi	-0.0166	0.404***	-1.069
	(0.0560)	(0.0763)	(1.487)
Project Beneficary	-0.0854*	0.0492	0.198
	(0.0461)	(0.0450)	(1.136)
Constant	0.212	0.247**	6.599***
	(0.133)	(0.106)	(1.420)
Observations	350	350	350

Standard errors clustered at the village level
* p < 0.1, **, p < 0.05, *** p < 0.01

5.9 Bibliography

Albutt, K., J. Kelly, J. Kabanga, and M. VanRooyen (2017). Stigmatisation and rejection of survivors of sexual violence in eastern Democratic Republic of the Congo. *Disasters 41*(2), 2110227.

Asadullah, M. N. and A. Savoia (2018). Poverty reduction during 1990–2013: Did millennium development goals adoption and state capacity matter? *World Development 105*, 70–82.

Autesserre, S. (2012). Dangerous tales: Dominant narratives on the Congo and their unintended consequences. *African Affairs 111*(443), 202–222.

Baaz Eriksson, M. and M. Stern (2013). *Sexual violence as a weapon of war? Perceptions, prescriptions, problems in the Congo and beyond*. London, UK: Zed Books.

Babalola, S., A. Gill-Bailey, and M. Dodo (2014). Prevalence and Correlates of Experience of Physical and Sexual Intimate Partner Violence among Men and Women in Eastern DRC. *Universal Journal of Public Health 2*(1), 25–33.

Bartels, S., J. Kelly, J. Scott, J. Leaning, D. Mukwege, N. Joyce, and M. VanRooyen (2013). Militarized Sexual Violence in South Kivu, Democratic Republic of Congo. *Journal of Interpersonal Violence 28*(2), 340–358.

Bhattacharya, M., A. S. Bedi, and A. Chhachhi (2009). Marital Violence and Women's Employment and Property Status Evcidence from North Indian Villages.

Blair, G. and K. Imai (2012, jan). Statistical Analysis of List Experiments. *Political Analysis 20*(1), 47–77.

Blair, G., K. Imai, and J. Lyall (2014). Comparing and combining list and endorsement experiments: Evidence from Afghanistan. *American Journal of Political Science 58*(4), 1043–1063.

Bueno, C. C. and E. A. Henderson (2017). Bargaining or Backlash ? Evidence on Intimate Partner Violence from the Dominican Republic. *Feminist Economics 23*(4), 90–116.

Bulte, E. H. and R. Lensink (2019). Women's empowerment and domestic abuse: Experimental evidence from Vietnam. *European Economic Review 115*, 172–191.

Chuang, E., P. Dupas, E. Huillery, and J. Seban (2019). Sex, Lies and Measurement.

Corstange, D. (2009). Sensitive questions, truthful answers? Modeling the list experiment with LISTIT. *Political Analysis 17*(1), 45–63.

Dave, C., C. C. Eckel, C. A. Johnson, and C. Rojas (2010). Eliciting risk preferences: When is simple better? *Journal of Risk and Uncertainty 41*(3), 219–243.

Eckel, C. C. and P. J. Grossman (2002). Sex differences and statistical stereotyping in attitudes toward financial risk. *Evolution and Human Behavior 23*(4), 281–295.

Eswaran, M. and N. Malhotra (2011). Domestic violence and women 's autonomy in developing countries : theory and evidence. *Canadian Journal of Economics 44*(4), 1222–1263.

Freedman, J. (2011). Explaining sexual violence and gender inequalities in the DRC. *Peace Review 23*(2), 170–175.

Frye, T., S. Gehlbach, K. L. Marquardt, and O. J. Reuter (2017). Is Putin's popularity real? *Post-Soviet Affairs 33*(1), 1–15.

Gibbs, A., J. Corboz, E. Chirwa, C. Mann, F. Karim, M. Shafiq, A. Mecagni, C. Maxwell-Jones, E. Noble, and R. Jewkes (2020). The impacts of combined social and economic empowerment training on intimate partner violence, depression, gender norms and livelihoods among women: An individually randomised controlled trial and qualitative study in Afghanistan. *BMJ Global Health 5*(3), 1–17.

Harvard Humanitarian Initiative (2009). Characterizing Sexual Violence in the Democratic Republic of the Congo: Profiles of Violence, Community Responses, and Implications for the Protection of Women. pp. 1–64.

Hidrobo, M., A. Peterman, and L. Heise (2016). The effect of cash, vouchers, and food transfers on intimate partner violence: Evidence from a randomized experiment in Northern Ecuador. *American Economic Journal: Applied Economics 8*(3), 284–303.

Hilhorst, D. and N. Douma (2018). Beyond the hype? The response to sexual violence in the Democratic Republic of the Congo in 2011 and 2014. *Disasters 42*(S1), S79–S98.

Holbrook, A. L. and J. A. Krosnick (2010). Social desirability bias in voter turnout reports: Tests using the item count technique. *Public Opinion Quarterly 74*(1), 37–67.

Holt, C. A. and S. K. Laury (2002). Risk Aversion and Incentive Effects. *American Economic Review 92*(5), 1644–1655.

Human Rights Watch (2002). The war within the war : sexual violence against women and girls in Eastern Congo. Technical report.

Human Rights Watch (2009). *Soldiers who rape, commanders who condone: Sexual violence and military reform int he Democratic Republic of Congo*. New York: Human Rights Watch.

Imai, K. (2011). Multivariate regression analysis for the item count technique. *Journal of the American Statistical Association 106*(494), 407–416.

Johnson, K., J. Scott, B. Rughita, M. Kisielewski, J. Asher, R. Ong, and L. Lawry (2010). Association of Sexual Violence and Human Rights Violations With Physical and Mental Health in Territories of the Eastern Democratic Republic of the Congo. *JAMA 304*(5), 553–562.

Kelly, J., E. Colantuoni, C. Robinson, and M. R. Decker (2018). From the battlefield to the bedroom: A multilevel analysis of the links between political conflict and intimate partner violence in Liberia. *BMJ Global Health 3*(2), 1–11.

Kilonzo, N., N. Ndung'u, N. Nthamburi, C. Ajema, M. Taegtmeyer, S. Theobald, and R. Tolhurst (2009). Sexual violence legislation in sub-Saharan Africa: the need for strengthened medico-legal linkages. *Reproductive Health Matters 17*(34), 10–19.

Kirby, P. (2015, may). Ending sexual violence in conflict: The Preventing Sexual Violence Initiative and its critics. *International Affairs 91*(3), 457–472.

Kohli, A., M. T. Makambo, P. Ramazani, I. Zahiga, B. Mbika, O. Safari, R. Bachunguye, J. Mirindi, and N. Glass (2012). A Congolese community-based health program for survivors of sexual violence. *Conflict and Health 6*(1), 1–9.

LaBrie, J. W. and M. Earleywine (2000). Sexual risk behaviors and alcohol: Higher base rates revealed using the unmatched-count technique. *Journal of Sex Research 37*(4), 321–326.

Martinsson, P., M. Sutter, and F. Carlsson (2009). Household Decision Making and the Influence of Spouses ' Income , Education , and Communist Party Membership : A Field Experiment in Rural China.

Meng, T., J. Pan, and P. Yang (2017). Conditional Receptivity to Citizen Participation: Evidence From a Survey Experiment in China. *Comparative Political Studies 50*(4), 399–433.

MPSMRM, MSP, and ICF International (2014). République Démocratique du Congo Enquête Démographique et de Santé (EDS-RDC) 2013-2014. Technical report, Ministère du Plan et Suivi de la Mise en œuvre de la Révolution de la Modernité.

Müller, C. and J. P. Tranchant (2019). Domestic Violence and Humanitarian Crises: Evidence from the 2014 Israeli Military Operation in Gaza. *Violence Against Women 25*(12), 1391–1416.

Palermo, T. and A. Peterman (2011). Undercounting, overcounting and the longevity of flawed estimates: Statistics on sexual violence in conflict. *Bulletin of the World Health Organization 89*(12), 924–925.

Peterman, A., T. Palermo, and C. Bredenkamp (2011, jun). Estimates and determinants of sexual violence against women in the Democratic Republic of Congo. *American journal of public health 101*(6), 1060–7.

Peterman, A., T. Palermo, S. Handa, and D. Seidenfeld (2018). List randomization for soliciting experience of intimate partner violence: Application to the evaluation of Zambia's unconditional child grant program. *Health Economics (United Kingdom) 27*(3), 622–628.

Peterson, C., Y. Liu, M.-j. Kresnow, C. Florence, M. T. Merrick, S. DeGue, and C. N. Lokey (2018, jul). Short-term Lost Productivity per Victim: Intimate Partner Violence, Sexual Violence, or Stalking. *American Journal of Preventive Medicine 55*(1), 106–110.

Porter, H. (2019). Moral Spaces and Sexual Transgression: Understanding Rape in War and Post Conflict. *Development and Change 50*(4), 1009–1032.

Post, L. A., N. J. Mezey, C. Maxwell, and W. N. Wibert (2002). The Rape Tax: Tangible and Intangible Costs of Sexual Violence. *Journal of Interpersonal Violence 17*(7), 773–782.

Raleigh, C., A. Linke, H. Hegre, and J. Karlsen (2010). Introducing ACLED: An armed conflict location and event dataset. *Journal of Peace Research 47*(5), 651–660.

Saile, R., F. Neuner, V. Ertl, and C. Catani (2013). Prevalence and predictors of partner violence against women in the aftermath of war: A survey among couples in Northern Uganda. *Social Science and Medicine 86*, 17–25.

Samy, Y. and D. Carment (2011). The Millenium Development Goals and Fragile States: Focusing on What Really Matters. *The Fletcher Forum of World Affairs 35*(1), 91–108.

Sniderman, P. M., P. E. Tetlock, and T. Piazza (1991). Codebook for the 1991 Race and Politics Survey. Technical report, University of California, Berkeley.

Stark, L., M. Sommer, K. Davis, K. Asghar, A. A. Baysa, G. Abdela, S. Tanner, and K. Falb (2017). Disclosure bias for group versus individual reporting of violence amongst conflict-affected adolescent girls in DRC and Ethiopia. *PLoS ONE 12*(4), 1–12.

Steiner, B., M. T. Benner, E. Sondorp, K. P. Schmitz, U. Mesmer, and S. Rosenberger (2009). Sexual violence in the protracted conflict of DRC programming for rape survivors in South Kivu. *Conflict and Health 3*(1), 1–9.

Tsai, C.-l. (2019). Statistical analysis of the item-count technique using Stata. *The Stata Journal 19*(2), 390–434.

United Nations (2015). The Millennium Development Goals Report. *United Nations*, 72.

Verwijen, J. (2016). *A Microcosm of Militarization: Conflict, Governance and Armed Mobilization in Uvira, South-Kivu*. Nairobi, Kenya: Rift Valley Institute/Usalama Project.

Chapter 6

Conclusion

The preceding chapters each presented local evidence on development. Each chapter discussed a subset of the of the risks and opportunities that I presented in Chapter 1, and their impact on development, focusing on different countries: Sierra Leone, DRC and Cameroon. Data collection in such settings is difficult and costly, but detailed is needed to get detailed insights at the local level. Such a local perspective allowed me to asses how the effects of these risks and opportunities are mediated through social capital and behaviour, which is important as such mediation may have surprising, or unintuitive consequences for the impacts that these risks and opportunities have on development. In this concluding chapter, I will briefly summarize the findings of each chapter, and then provide a synthesis focusing on the implications of these findings for development policy.

At the core of Chapter 2 is the question whether conflict affects competitive behaviour among youths in Eastern Sierra Leone. While conflict is an import risk to development, competitive behaviour may play a role in fostering development. We invited football players from a youth tournament to participate in a post-game research activity comprising a short questionnaire and a number of behavioural experiments. We found that the larger the exposure to conflict a player had seen, the more competitively they behaved in an effort game when matched with players from opposing teams, and the more foul cards they received in the football tournament. This highlights how unexpected the behavioural links between conflict and development can be and points at a potential (minor) upside of conflict to development: it may transform society to become dynamic, and more competitive, thus promoting economic development.

An important component of development is agricultural productivity. However, in Africa this productivity is constrained by low adoption of inputs. Chapter 3 revolves around the effectiveness of input subsidization as a way to remove this constraint. The chapter presents evidence from an impact evaluation of a project that provided subsidized input packages (including fertilizer, inoculant and seeds) to smallholder farmers in South Kivu province in the eastern DRC. The results suggest that the project

effected an increase in use of both fertilizer and inoculant the year after the subsidized packages were provided. However, we were unable to find any impacts on yields and food security, perhaps because these are harder to measure with any precision. While these results suggest potential for subsidy programs, an important caveat is in place. When comparing the impact in villages that are close to markets to the impact in villages that are not, we find that the positive effects on input adoption is concentrated in villages closest to markets. This suggests that the project's success does not exist in a vacuum, but is context dependent. In this specific case, market access is an important enabling factor for the intervention.

While Chapter 3 suggests an important role for markets in enabling supply of inputs, markets may have more indirect effects on development as well. In Chapter 4 we explore the effects of market exposure on behaviour in an investment game. Specifically, we consider three determinants of sending behaviour in the game (social preferences, expectations and risk preferences) and examine how the effects of these determinants vary between villages with and without market exposure. When considering these determinants across the entire research population, we find that our respondents are strongly motivated by social preferences, but we find no evidence that they are motivated by expectations. In other words, they consider the game an opportunity to transfer money to a fellow villager, rather than an investment opportunity to get money back. However, when separating villages with and without markets, we do find an effect of expectations in the market villages: respondents with market exposure are more likely to see the money sent as an investment. This suggests that the impacts of markets on development goes deeper than providing a mechanism for the efficient allocation of resources. The repeated interactions with (and perhaps dependence on) relative strangers changes the way people behave. This could be either through a learning effect, where people learn from the interactions with strangers and are thus more comfortable in trusting them, or that the framing of market interaction lead people to behave more rationally (see e.g. List and Millimet, 2008; Cecchi and Bulte, 2013), and thus more likely to send money to people if they expect them to return some of it .

In chapter 5, I analysed the results from a list experiment, in order to identify potential drivers of SGBV in Eastern Congo.I found high rates of incidence of SGBV: I estimate that 30% of the women in the sample were the victim of SGBV in the twelve months preceding data collection. I find that incidence rates are higher among women married to higher-status men, among women who have low intra-household bargaining power, and among women with a history of conflict. I find no relation between recent conflict and SGBV victimization. These findings go against the common narrative where SGBV in DRC is framed as "weapon of war". While I do find evidence of a link between violent conflict and SGBV, addressing the high incidence rates takes more than an end to violent conflict. A first condition should be to improve the position of women in Congolese society. The fact that women who have attended secondary school are hardly ever victimized by SGBV may point at an effective strategy, but more research is needed to

prove a causal link.

A key argument in this thesis has been the importance of conducting empirical research at the local level. So how do these findings differ from the common wisdom based on national-level experiences? Does our appreciation of the impact that markets, conflict and aid have on development change when assessing it through a local lens? As for conflict, the impact of conflict remains decidedly negative. But at the local level, the findings presented in Chapter 2 complement a growing literature on the behavioural effects of conflict, not all of which are bad. Taken together with earlier findings that conflict increases in-group pro-social behaviour Bellows and Miguel (2009); Voors et al. (2012); Gilligan et al. (2014); Bauer et al. (2014) and political engagement Bellows and Miguel (2009); Blattman (2009), our findings suggest that the experience of conflict has some positive effects on development which may be important to post-conflict recovery.

Despite these possible positive impacts on development, conflict remains associated with overwhelmingly negative outcomes. Chapter 5 deals with one such outcome: SGBV. The rampant levels of SGVB place a huge burden on the Congolese people (it is important to note that even though the focus in this thesis is on women, victimization rates among men are high as well (Christian et al., 2011)). While it is common to attribute this violence to the conflict, such a narrow framing risks missing the larger problems that persist within Congolese society (see e.g. Autesserre, 2012). The findings presented in Chapter 5 suggest that violence persists long after the conflict has ended, and that in order to prevent violence, the position of women in Congolese society must be improved.

As for markets, their most obvious role in economic development is to improve economic efficiency by decreasing transaction costs. This is evidenced by the finding in Chapter 3 that aid has more impact closer to markets: after all, farmers with good market access can more easily obtain inputs and sell outputs. However, this is not the only impact: markets also increase the number of interactions with strangers, which requires a different set of norms, and a different set of expectations, than dealing with your close kin and neighbours. The findings from Chapter 4 are one example of the benefits this could have: increased levels of trust between members of the community. This is in line with existing literature on the effect that large-scale societies have on social preferences (Henrich et al., 2010).

Finally, development aid. Unlike conflict and markets, development aid provides a policy lever with scope for adjustment. And the findings presented above have various implications for how to ensure we properly use this policy lever. The evidence presented in Chapter 3 suggests that relatively light interventions can produce results, even in difficult areas such as DRC. The findings also suggest that the project did not achieve impact everywhere, suggesting that better targeting is in order. Such targeting can only be effective given good and reliable data. Another example of how data can better guide development policy flows from the findings of Chapter 5: where a large part of the development community may view

conflict as the sole driver of SGBV, detailed micro-level data suggests reality may be more complex, and require different policies to address the problem. Of course not every detailed micro-level finding has great implications for development policy. The unexpected benefits of conflict and markets as presented in chapters 2 and 4 respectively may be interesting for academics, but they may be too small for a development organization to meaningfully engage with. However, like the respondents from Chapter 4 behaved differently than the students commonly used in lab settings, people in a different conflict, or at a different point in a market exposure gradient, may change their behaviour more drastically. Development organizations fully ignoring the possibility of such unforeseen benefits thus may be leaving money on the table.

This thesis started out with the observation that the extreme poverty in the world is increasingly concentrated in a small number of countries, defying global trends of increasing prosperity. The arguments outlined above mean we cannot simply make assumptions about the relationships between the risks and opportunities that these countries face, and their development trajectory. Conflict does not only have downsides, SGBV in conflict areas will not be solved through peace treaties and markets do more than just allocate goods. This means that development experts (practitioners and academics alike) should be modest about their knowledge of what drives poverty. We should be diligent about checking the assumptions behind development policy, and monitor their effect, so that efforts can be focused where the needs are greatest, and the potential for impact largest. Such data collection is costly and often risky, but the alternative may be basing our policy based on faulty assumptions (such as the "weapon war" view of SGBV discussed in this thesis), leading to less effective aid. In this way, such faulty assumptions are more costly than data collection, and those costs will be borne by those who depend on aid, who are often the most vulnerable.

6.1 Bibliography

Autesserre, S. (2012). Dangerous tales: Dominant narratives on the Congo and their unintended consequences. *African Affairs 111*(443), 202–222.

Bauer, M., A. Cassar, J. Chytilová, and J. Henrich (2014, jan). War's Enduring Effects on the Development of Egalitarian Motivations and In-Group Biases. *Psychological science 25*(1), 47–57.

Bellows, J. and E. Miguel (2009). War and local collective action in Sierra Leone. *Journal of Public Economics 93*(11-12), 1144–1157.

Blattman, C. (2009). From Violence to Voting: War and political participation in Uganda. *American Political Science Review 103*(2), 231–247.

Cecchi, F. and E. H. Bulte (2013). Does Market Experience Promote Rational Choice ? Experimental Evidence from Rural Ethiopia. *Economic Development and Cultural Change 61*(2), 407–429.

Christian, M., O. Safari, P. Ramazani, G. Burnham, and N. Glass (2011). Sexual and gender based violence against men in the Democratic Republic of Congo. *Medicine, Conflict and Survival 27*(4), 227–246.

Gilligan, M. J., B. J. Pasquale, and C. Samii (2014). Civil War and Social Cohesion: Lab-in-the-Field Evidence from Nepal. *American Journal of Political Science 58*(3), 604–619.

Henrich, J., J. Ensminger, R. McElreath, A. Barr, C. Barrett, A. Bolyanatz, J. C. Cardenas, M. Gurven, E. Gwako, N. Henrich, C. Lesorogol, F. Marlowe, D. Tracer, and J. Ziker (2010). Markets, Religion, Community Size and the Evolution of Fairness and Punishment. *Science 327*(5972), 1480–1485.

List, J. A. and D. L. Millimet (2008). The Market: Catalyst for Rationality and Filter of Irrationality. *The B.E Journal of Economic Analysis & Policy 8*(1), 1935–1682.

Voors, M. J., E. E. M. Nillesen, P. Verwimp, E. H. Bulte, R. Lensink, and D. P. V. Soest (2012). Violent Conflict and Behavior: A Field Experiment in Burundi. *American Economic Review 102*(452), 941–964.

Summary

The global poor are increasingly concentrated in a limited number of countries. The World Bank expects that by 2030, up to two thirds of the world's extremely poor live in Fragile Conflict-affected settings, and mostly in rural areas. This thesis aims to investigate the local dynamics that underlie (or are caused by) the lack of development. The core argument in this thesis is that the effect of each of these risks and opportunities on development outcomes is not direct.

Chapter 2 is based on fieldwork around a street football tournament in Kenema, Eastern Sierra Leone. Using a set of lab-in-the-field experiments, we evaluate the impact of exposure to violent conflict on competitive behaviour. We find that conflicted affected youth in our sample are more likely to get a yellow or red card during the football tournament, are less risk averse, display more pro-social behaviour to their teammates and are more competitive towards their opponents. These findings complement a growing literature on the relationship between conflict and (pro-social) behaviour. This effect of conflict on behaviour may have consequences for long-term development.

Chapter 3 examines the impact of a program that provides subsidized inputs to smallholder farmers in Eastern DRC using a field experiment. We find that two agricultural seasons after the subsidy program, the use of inputs remained higher in the communities receiving the subsidy compared to those that did not. Fertilizer was increased by five percentage points, while the use of inoculant (a novel nitrogen-fixing technology) was increased by three percentage points. Given the low initial input use in the sample, these increases are substantial, and the fact they persist two seasons after the provision of the subsidies points to a structural improvement of adoption. However, we do not find evidence of increased yields or improved food security. Furthermore, input use further away from market towns was not affected, suggesting that the success of such programs highly depend on the context.

Chapter 4 explores the relationship of sending behaviour in an Investment Game and exposure to markets, a common indicator of trust. We use the results of an Investment Game played with over 3,000 rural household heads in Northern Cameroon. We find that, on average, respondents in Cameroon are less driven by expectations of reciprocity (trust) and more by social preferences than respondents in previous studies, often done using populations of university students. However, when we split our sample

in a group with market experience and one without, we find that expectations do drive sending behaviour in the market group. There may be a learning effect where increased interactions on markets (often with strangers) may lead people to be more willing to act on their expectations.

Chapter 5 explores the drivers of SGBV in Easter Congo by examining the characteristics of the victims. To measure victimization without suffering from social desirability bias I conducted a list experiment. I find high rates of victimization: 30% of the women in my sample have been victimized in the 12 months prior to the interview. The victims are likely to be married to higher-status men, have low intra-household bargaining power, and have been exposed to violent conflict to the extent where they have lost family or household members before 2012 (two years before the list experiment). These results are not in line with the view that SGBV is mostly caused by direct perpetration by armed groups. Rather, it suggests that there may be a long-term effect of violent conflict on intimate partner violence. This suggests that the problem of SGV in DRC can only be addressed by imporiving the position of women in Congolese households and society in general.

Chapter 6 provides a synthesis of these results, linking them back to the original problem statement of poverty being increasingly concentrated in a limited number of countries. The chapter argues that this requires extensive local level data collection to ensure that development programs have the desired effect.

Acknowlegdements

First of all, I would like to thanks Dieudonnee Mundi; not only were his knowledge and helpfulness essential to the data collection of me and other researchers around Bukavu, Mundi's gracious hospitality made us all feel like part of his family, which made long stays in Bukavu something to look forward to. His untimely death leaves a gap for the research community that will be extremely difficult to fill.

My family has been important throughout. This includes my parents and brothers, but especially my partner, Aster, who has been supportive of me finally finishing this project. Special thanks are in order for Vanja: even though she is too young to have seen much of the work that has gone in this thesis, she was an enormous inspiration in finishing it.

During field work, I have had great research assistance from Eva, Evelien, Biho, Imke, Karin, Romy, Alexandra, John and Megan. The field work in Congo was done in close cooperation with the Université Catholique Bukavu, in particular Janvier, and the Université du Graben, where Kennedy has been a great help. In Cameroon, we worked closely with the Institut National de la Statistique, who did tremendous work in making field work possible. I have had even more assistance from many interviewers in all of these countries, especially Chance Jacques, Papy, Eustache, Freddy, Raymond, Bakari and Aisha.

Science is a team sport, and fortunately the DEC department is filled with great team players. Of great support to me have been my supervisors Maarten and Marrit, and my promotor Erwin.

My co-authors have also been a joy to work with. I've spent months in Cameroon with Niccolò, who is surprisingly knowledgeable about the Cameroonian musical genres of Makossa and Bikutsi. In Sierra Leone, I spent much time with Maarten and Francesco, both of whom have contributed to more valuable insights than could have possibly been included in a thesis, including thorough (though perhaps not entirely emprically grounded) investigations into the arboreal feeding habits of Choeropsis Liberiensis and into the unexpected relationship between various local species of Cephalophinae, urban crime and inter-city transport within Sierra Leone. With my DEC co-authors on Chapter 3, Martha, Janneke and Lonneke, I've spent only a short time in Bukavu, but fortunately more time in the Netherlands. Martha especially has been a frequent guest at our house and has been a great inspiration: not only on getting that PhD finished, but also on getting a dog (said dog has helped greatly in keeping sane while getting

that PhD finished).

There are many folks at DEC who are not co-authors, but have contributed greatly to the atmosphere that makes it such a good place to work. This includes Zihan, Paul, Aussi, Jan, Maria, Landry, Haki, Ian, Gonne, and all others I've spent so much time with during coffee break, group drinks and football games. One more reason DEC is such a great place to work, is the fabulous support staff, who make it possible to navigate the bureacratic maze that the university can be. So big thanks are in order for Marian, Dineke, Gré, and Betty.

Finally, I have combined finalizing this PhD project with jobs at EDI and the VU. While combining a PhD with a job was difficult at times, my colleagues at both these places have made it a joy.

Data Statement

The data for this thesis is not publically available: the data contains highly sensitive information which cannot be made public wihtout the potential for harm to the respondents. In accordance with the Netherlands Code of Conduct for Research Integrity, the data is archived on a secure department server and available for verification purposes in case of doubts about integrity of the research described in this thesis. For details on how to access this data contact the author, or office.economics@wur.nl.

The Stata code for all data cleaning and analysis, as well as all documentation such as questionnaires and interviewer manuals are available on 4TU.nl, the public data repository for the technical universities of the Netherlands, under the following DOI: 10.4121/21456453

The research described in this thesis was financially supported by NWO-WOTRO, the Economic and Social Research Council (ESRC, grant ES/J009008/1) and SNV.

Koen Leuveld
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Wageningen School of Social Sciences

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
Advanced Micro Economics	WUR - UEC51806	2012	6
Advanced Econometrics	WUR - AEP33806	2019	6
Machine Learning	WUR - FTE35306	2019	6
B) General research related competences			
Writing research proposal	WU	2012-2019	3
CS50x – Computer Science	HarvardX	2014	6
Scientific Writing	Wageningen in'to Languages	2016	1.8
Summer School: Experiments in Developing Countries	RUG	2016	1
C) Career related competences/personal development			
'Dissecting an investment game: Evidence from a field experiment in rural Cameroon'	NIBS Workshop, Nottingham	2015	1
'The role of local authorities in development aid: Evidence from South-Kivu'	Workshop mining, conflict, and post-conflict reconstruction in Eastern DRC, Antwerpen	2015	1
'Présentation résultats Quantitatives DFID'	Atelier des Résultats DFID/N2Africa, Bukavu,	2016	1
'The impact of agricultural extension and input subsidies in Eastern DRC'	12th Annual Workshop of the Households in Conflict Network, Rome,	2016	1
CSD Basic Security	CSD	2013	1
Supervision of students and education	WU	2012-2016	2
Total			**37**

*One credit according to ECTS is on average equivalent to 28 hours of study load