The Impact of Peace: Evidence from Nigeria

Tillman Hönig *
London School of Economics

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Abstract

This paper studies the economic consequences of peace – or conversely, conflict – in Nigeria. I exploit a natural experiment in the country: In 2009, the Nigerian government implemented a peace policy in the Niger Delta region. This is used as a policy shock to assess the effect of a conflict reduction. My first finding is that a peace period followed the introduction of the policy in the region. To evaluate the benefits of this peace, I then construct a synthetic control region from the states that are not part of the Niger Delta region and therefore unaffected by the policy as a within-country counterfactual to the Niger Delta region. I find that peace increased household expenditures by 19% four years later. In order to assess potential mechanisms behind this economic upturn, I consider self-employment income and education. I find an increase in self-employment income by 67% and in education by 0.5 years of schooling. While few papers study the link between conflict and business activity, the strong increase of self-employment income in response to peace suggests that this is an important relationship for policy consideration.

JEL classification: D12, D74, I25, J31, O12

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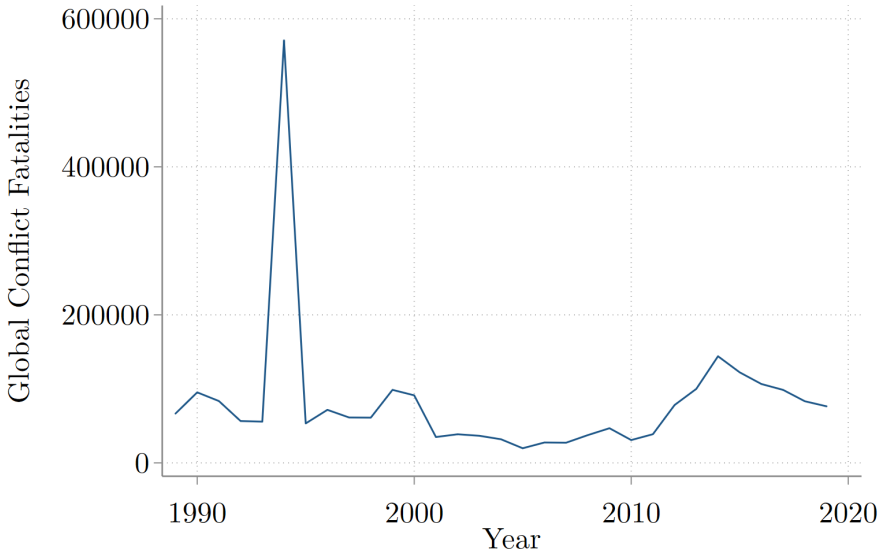
1 Introduction

Pax Europaea – the period of relative peace in Europe since World War II – is considered one of the most fundamental drivers of economic prosperity on the continent for the last 70 years or so. By contrast, many countries in the world have experienced periods of war and civil conflict since the second half of the 20th century began. While the world has made enormous progress in reducing extreme poverty in the last few decades, the lack of a downward trend in global conflict is particularly concerning. Figure 1 displays the total number of conflict fatalities over the last three decades. With the exception of two peaks in the mid-1990s (Rwandan genocide) and more recently in 2014 (Syrian civil war), the global death toll has stayed fairly constant in this time period. As almost a million people have died in violent conflict in the last decade alone, it remains one of the largest global challenges.

Figure 1: Global Conflict



Note – Data based on the UCDP GED version 20.1 that covers 1989-2019 (Pettersson & Öberg, 2020).

In spite of the extent and destructive power of global conflict, economists have only started to study it towards the very end of the 20th century. Blattman & Miguel (2010) provide an excellent review of the literature on civil wars which are the dominating driver of global conflict fatalities in recent decades. While the most recent micro-empirical literature has explored the economic consequences of violent conflict within different countries, it has focused strongly on human capital as a mechanism of the impact of conflict. In so doing, the great majority of studies have employed difference-in-differences (DID) identification strategy using cohort and conflict variation or instruments to identify the effect of civil war.

This paper exploits a regional peace policy in Nigeria to shed light on consequences of conflict. Specifically, I ask two questions. First, does peace follow the policy in the

Niger Delta region where it was carried out? Second, having established peace, what is the impact of it – or conversely interpreted, conflict – on overall economic performance, self-employment income and education?

The two key contributions of this analysis are the following. First, on the mechanisms front, while the link between conflict and business activity has received little attention so far, I highlight that this can be an important channel. Indeed, my quantitatively strongest result establishes that there is a large peace dividend[1] for the self-employed. Second, and methodologically, I employ the synthetic control method (SCM) in my evaluation. The method was developed by Abadie & Gardeazabal (2003) in the analysis of conflict on economic performance in the Basque Country in Spain. It has since been used rarely in similar evaluations but this is the first study, to the best of my knowledge, to apply it in the analysis of other outcomes than overall economic performance. This is an important advancement in the literature on the mechanisms of a conflict impact because the method can overcome common pitfalls of alternatively used methodologies. In particular, the commonly used DID approach requires a parallel trend between areas affected by conflict and those that are not. Using data during and after the conflict in Nigeria, I can show that this assumption is violated in my context.

The peace policy analyzed in this study is the Presidential Amnesty Program (PAP) that the Nigerian government implemented in the southeastern Niger Delta region in 2009. The program was a response to resistance activism in the region which turned violent in 2006 and escalated into intense conflict within a few years. In the context of the amnesty program, ex-militants were granted pardon and joined a "Disarmament, Demobilization and Reintegration" (DDR) program in return for surrendering their weapons. In a first step, I document that a period of peace follows the program in the Niger Delta region for at least four years.[2]

Along with the fact that other parts of Nigeria experience conflict between 2009 and 2013, this provides a unique quasi-experimental setting for the second and main step of my analysis: Estimating the benefits of peace. The empirical strategy is to create a synthetic control region as a weighted average of other states outside the Niger Delta region. The weights are chosen in a way that the synthetic control region resembles the Niger Delta

[1] The term 'peace dividend' is used in the literature to refer either generally to benefits of newly established peace or, in a different and much more specific context, the potential gains generated by shifting government resources from military expenditures to other uses. Henceforth, I refer to the first notion when using the expression.

[2] While such a simple time series analysis does not conclusively prove that peace can (only) be attributed to the amnesty program implemented, it would certainly strongly suggest that the policy had a role to play. In any case, for my main analysis of the economic benefits of peace, documenting a period of peace between 2009 and 2013 is sufficient, no matter whether it was (fully) due to the peace policy or not. Indeed, the success of demobilization programs is far from guaranteed. Some papers on such programs in particular (D'Aoust et al., 2018; Gilligan et al., 2012; Humphreys & Weinstein, 2007) or the link between development programs and conflict more generally (Beath et al., 2011; Berman et al., 2013, 2011; Crost et al., 2014, 2016) deliver ambiguous results. Both for repeat violence and economic outcomes, positive, zero and negative effects are found in the literature. The only common theme that seems to emerge to some extent, elaborated on both theoretically and empirically particularly in Berman et al. (2011), is that locally specific programs tend to have a higher probability of success. As opposed to the national DDR programs discussed in the literature, the one I consider is carried out only in the Niger Delta region and in this sense somewhat more local. My finding of conflict reduction in the region following the policy broadly fits within the emerging theme of local success.

region in all outcome variables closely before the policy is put in place. Serving as a counterfactual, this allows me to estimate the peace dividend by simply comparing the Niger Delta region and its synthetic control region four years later.

As a measure of the overall economic performance, I consider household expenditures. To shed light on some mechanisms that could potentially drive an effect on economic performance in the medium or long run, I also consider education and self-employment income as outcome variables. While education has received a lot of attention in the literature already, there is, to the best of my knowledge, only one study that analyzes self-employment income as an outcome of conflict (Velásquez, 2020). Yet, the effect I find for this outcome is the largest one among the three outcomes.

My main findings on economic outcomes are that peace increases household expenditures at the median by 19%, generates 0.5 more years of schooling on average and increases self-employment income at the median by 67% four years later. These results are robust to the alternative DID specification for education where the parallel trend assumption holds and deviate from the specification exactly in the direction of the parallel trend deviation where said assumption is violated. I provide further robustness against migration driving this result in an analysis concerning potential spillover effects from population movement. As a general caveat, however, it is worth noting that my standard errors and other measures imply that there is a substantial degree of uncertainty around my average effects, so that none of my findings should be taken as very precise point estimates.

The effect on household expenditures is indeed large but consistent with most closely comparable studies that evaluate the impact of conflict using the synthetic control method in other contexts (Abadie & Gardeazabal, 2003; Dorsett, 2013; Gong & Rao, 2016; Matta et al., 2016). More broadly, the result is also in line with an (older) macroeconomic literature that establishes a negative link between conflict experience and economic performance, at least in the short and medium run (Alesina & Perotti, 1996; Barro, 1991; Cerra & Saxena, 2008; Collier, 1999).[3]

An important driver of increased economic prosperity as a result of peace seems to be improved (small) business activity in the Niger Delta region. As the Niger Delta is an oil-rich region, it may however be plausible to have such large effects. With oil production picking up as a consequence of peace (Walls & During, 2020), not only will small businesses surrounding the oil industry benefit, but also all other kinds of businesses that use oil or derivative products as key inputs.

There are only few studies that analyze the effect of peace or conflict on business activity (Bozzoli et al., 2012; Camacho & Rodriguez, 2013; Collier & Duponchel, 2013;

[3]To what extent such effects persist in the long run or whether there is convergence in line with the logic of the Solow model is not clear. While some estimates suggest there is convergence, other studies find evidence for the opposite. In particular, some direct evidence on GDP (Chen et al., 2008; Gates et al., 2012; Miguel & Roland, 2011) and on city size (Brakman et al., 2004; Davis & Weinstein, 2002) suggest convergence. By contrast, other direct evidence on GDP (Akbulut-Yuksel, 2014; Galdo, 2013; Islam et al., 2016) find no convergence. The below mentioned range of studies on education outcomes that should affect economic performance according to standard theory would also suggest that there is no convergence, at least not within a lifetime of those affected by conflict.

Deininger, 2003; Velásquez, 2020). This is partly owed to the problem of identification. Existing papers almost exclusively employ time and conflict variation for identification which requires both pre- and post-conflict observations. In particular for longer conflicts, this is a non-trivial data requirement.[4] With the exception of Velásquez (2020), all studies consider the extensive margin only and find that conflict reduces the probability of running a business. Using average self-employment income allows me to capture both the extensive and intensive margin of (small) business activity. On the extensive margin, it captures the extent to which more productive business owners enter the market in a more conducive environment of peace as well as how their entry may induce more competition which crowds out low-productivity competitors and engenders higher average income in more productive businesses. On the intensive margin, it captures the extent to which already existing business owners increase their business activity. Another important contribution is expanding the methodological portfolio. This study is the first one to use the synthetic control method for the analysis of business outcomes.

With regards to the effect of conflict on education, the majority of papers employs a DID approach that exploits school age (cohort) variation and geographic conflict variation within a country (Akbulut-Yuksel, 2014; Akresh & De Walque, 2011; Chamarbagwala & Morán, 2011; Islam et al., 2016; Kesternich et al., 2014; Leon, 2012; Márquez-Padilla et al., 2015; Merrouche, 2011; Pivovarova & Swee, 2015; Saing et al., 2017; Shemyakina, 2011; Swee, 2015; Valente, 2014).[5] In light of the fact that the DID approach is predominantly used, it is not clear whether many of these studies suffer from systematic bias arising because of a potential violation of the parallel trend assumption or spillover effects. Using cohort variation, the parallel trend assumption would be violated if control cohorts in conflict areas are affected by conflict as well. Indeed, some studies that focus on primary education take younger people (older than 16 or 18) who could still reasonably be in secondary or tertiary education as control cohorts although they might also suffer in their educational outcomes as a result of the war.

I address both issues by using the synthetic control method and delivering robustness checks against relevant spillover effects, in particular around migration. Unlike the cohort variation used in DID approaches, the synthetic control procedure in my setting exploits pre- and post-peace data. The fact that I use the variation in actual time periods covering both conflict and peace enables me to much more clearly test the pre-trend on years before the peace-generating amnesty policy.[6] The fact that I find an effect that is broadly in line with the set of estimates found in the literature, ranging between a 0.2 and 1 year loss of

[4] Collier & Duponchel (2013) only have post-conflict data in their analysis of firm activity in Sierra Leone and make use of an instrument for identification. However, instrumental variable estimation strategies require a valid instrument for conflict which is typically hard to find as well.

[5] A notable exception is Blattman & Annan (2010) who can make use of a quasi-experimental setting with plausibly random 'recruitment' abductions by rebels in Uganda.

[6] Few DID studies can convincingly address parallel trend and spillover concerns, mainly because it is much harder to address such concerns in a DID setting with cohort variation. For example, the typical placebo tests fails to show an effect if control cohorts are indeed affected positively but in a similar way. In addition, many studies do not seriously consider migration during times of conflict which could be a main driver of spillover effects.

schooling as a result of conflict, provides further credibility to a strong effect of conflict on education. This is an important finding because it speaks in favor of a long-run effect of conflict on life outcomes such as earnings through the human capital channel.

The remainder of the paper is organized as follows. Section 2 provides some contextual background to the Niger Delta amnesty policy, section 3 informally explores potential theoretical channels involved in the consequences of conflict for education, self-employment income and household expenditures while section 4 describes the data. Section 5 explains and discusses the empirical design of my study in more detail, section 6 presents the results and section 7 delivers some relevant robustness checks. Finally, section 8 concludes.

2 Context

After independence from the British in 1960, a civil war in the late 1960s and almost thirty years of military rule following the civil war, Nigeria has been under the rule of democratically elected governments and presidents since 1999. However, different parts of Nigeria have still experienced various degrees of conflict after democratization. A particularly important region of Nigeria where this happened is the Niger Delta region.

This region is an oil rich region in the southeastern part of Nigeria. Since oil revenues account for a large part of the government's fiscal budget, it has traditionally been a very important region for policymakers (Abazie-Humphrey, 2014; Obi, 2014). As Obi (2014) lays out, the government has taken over federal control over oil in the 1960s and since then sharply decreased revenue derivation, that is, the share flowing into regional budgets. This has created tensions in the Niger Delta region and resistance activists have become a key actor since the late 1990s. In particular, the "Movement for the Emancipation of the Niger Delta" (MEND) has emerged and became violent from 2006, marking "an escalation from uncoordinated protests and conflicts into a trans-Delta insurgency." Their violent activities were characterized by oil worker abductions, attacks of government forces and oil installation sabotages which led to a conflict involving a rapid decrease in oil production and increase in fatalities.[7]

By the time Umaru Yar'Adua got elected as president in April 2007, the Niger Delta conflict has become a pressing issue for the government to solve due to its dependency on oil revenues. He announced an amnesty program on 25 June 2009 and established the "Niger Delta Peace and Conflict Resolution Committee" (NDPCRC) in July. The amnesty program targeted ex-militants and granted "unconditional pardon to all persons who have directly participated in the commission of offences associated with militant activities in the Niger Delta" in return for surrendering their weapons, renouncing the use of violence and taking part in a government-sponsored "Disarmament, Demobilization and Reintegration" (DDR) program (Obi, 2014). In fact, the DDR program was a key

[7]In fact, as can be seen below, the number of reported fatalities drastically escalates only in 2009. From 2006 to 2008, therefore, the conflict seems to have manifested itself rather in great uncertainty, pipeline explosions, and threat of terror.

and hugely expensive element of the program.[8] Ex-militants participating in the program received a monthly stipend of 65,000 NGN (Nigerian Naira, approx. 440 USD in 2009), support and vocational training to facilitate their reintegration into society. The amnesty program took effect on 6 August 2009 and militants had a period of 60 days to sign up (The Guardian, 2009). 20,192 rebels signed up during this period. However, further militants were still approved after the deadline which accumulated the total number of participants to 30,000 after all (Oluduro & Oluduro, 2012; Premium Times, 2012).

The statistics on post-2009 fatalities show and analysts generally agree that the program was effective in establishing peace in the region, at least for a couple of years (Abazie-Humphrey, 2014; Obi, 2014; Oluduro & Oluduro, 2012; Oluwaniyi, 2011).[9] Abazie-Humphrey (2014) argues that peace in the region served as a condition for development and growth through a more stable business environment and the completion of infrastructure project. In a simple analysis comparing mean outcomes for the artisan fishing industry, Achoja et al. (2013) find some suggestive evidence of an improved business situation. Therefore, it seems worthwhile to exploit the amnesty program as a policy shock generating peace to investigate its effect on a range of outcomes.

3 Theoretical Considerations

For each of the outcomes I consider, there are multiple channels how peace may affect them. Since the direction of the effect is usually clear, I resort to a brief verbal discussion of the possible mechanisms involved without a formal model. After all, the empirical exercise is mainly about the quantification of these effects. In addition, I focus on a discussion of the converse effect, namely the channels how conflict affects my outcomes of interest, in order to stay in line with the vast majority of the literature regarding and estimating the issue from this angle. The effect of peace naturally operates in the opposite direction.

As for GDP or general economic performance, Collier (1999) provides an overview of potential channels. Conflict leads to the destruction of resources, physical and human capital as well as infrastructure, disruption of order, diversion of public expenditure from output-enhancing activities, dissaving, increased uncertainty and decreased foreign investment. From this macro perspective, such effects should all lead to a reduction in economic performance. Conversely, peace as a reversion of these effects should lead to increased economic performance, especially in the medium and long run. However, related to the idea of a rapacity effect as a cause of conflict (Dube & Vargas, 2013), if there is conflict

[8] According to Abazie-Humphrey (2014) who refers to a press conference with Kingsley Kuku, the chairman of the amnesty program, annual budgets for the program up until 2014 amounted to more than 1.8 billion US dollar.

[9] These authors are, however, sceptical as to whether the policy is able to generate lasting peace. They generally criticize it for not addressing fundamental causes of the conflict in spite of the government's rhetoric viewing the policy as a pathway to sustainable peace. Indeed, some increases in conflict can be observed in the region from 2015, but in light of the Boko Haram insurgency affecting the whole country, it is difficult to causally link this to a failed amnesty policy. In any case, my analysis focuses on outcomes in 2013 and the data shows a period of peace between 2009 and 2013.

over a valuable resource (which is the case with oil in the Niger Delta), rebels benefit from resource theft and revenues. Therefore, for those households involved in conflict, peace may mean a drop in their economic performance, at least in the short run.[10] Nonetheless, it is plausible to expect the reversion of the above effects as peace unfolds to operate on a larger scale, be relevant for all households and therefore dominate potential immediate economic losses from resource theft in the medium and long run.

The effect on self-employment activity or income is partly related to general economic performance effects. The obvious link is that any changes in households' income translate into demand changes. A demand reduction translates into contraction of businesses providing the goods demanded. Other than through this link, conflict also directly affects self-employment. Destruction of infrastructure and increased uncertainty mean higher cost of production.[11] In the specific case of conflict over a natural resource, engaging in militant activity and resource theft also becomes an alternative supply of labor and some households may shift some labor into this activity which also reduces labor supplied to self-employment activity. Taken together, a contraction of self-employment businesses and higher cost of operation should lead to a reduction in self-employment income. Conversely, peace operates in the opposite direction of these effects and should lead to an increase in self-employment income.[12]

With regards to education, three channels are usually discussed in the literature. First, demand side factors may reduce the amount of schooling obtained during conflict. If conflict reduces financial resources,an income effect would lead to a reduction in (the consumption of) education since schooling is costly. Furthermore, especially in the context of developing countries and poor communities, if the reduction in financial resources pushes households below or close to the subsistence level, a substitution between education and income-generating work may kick in. Apart from this chosen education-labor substitution, involuntary education-labor substitution also occurs in incidences of child soldiering through forced recruiting or military draft. Second, supply side factors may reduce schooling. This includes the destruction of schools or conflict-related deaths of teachers. Third, a general situation of increased uncertainty and insecurity means that it is more dangerous to leave the house to attend public institutions.[13] When peace starts,

[10] This is reflected in the findings by Guidolin & La Ferrara (2007).

[11] Seiermann (2012) and Ksoll et al. (2016) provide specific examples. The former explores the infrastructure channel explicitly in Peru. She argues that destroyed infrastructure, in particular roads, leads to higher cost of market access for self-employed people who need to get to the next market to sell their products. The latter consider flower exporters in Kenya during times of electoral violence. They find that firms had to face increased labor absenteeism and pay higher wages as a compensation for coming to work in times of conflict. Although they consider (larger) firms, the mechanism is equivalent for self-employed businesses that employ labor.

[12] Self-employment activity may increase both on the intensive and extensive margin as a response to peace which both lead to higher self-employment income. On the intensive margin, business owners who invest more time and effort into their existing businesses generate more income. On the extensive margin, more businesses being set up result in more competition and crowding-out of the least productive businesses which would also result in higher income on average.

[13] Strictly speaking, this is a demand side factor as well but the focus here is on the substitution effect towards other goods arising from an increase in the cost of education. By contrast, the first channel focuses on the mere income effect from a reduction in financial resources. Therefore, this is often considered to be a conceptually distinct channel.

the reversion of all these effects should lead to an increase in education.

4 Data

4.1 Data Sources

I use two different sources of data for this study. The first is the Nigerian General Household Survey (GHS) with socio-economic data on Nigerian households. I use survey rounds 2006, 2007, 2008 and 2012 (National Bureau of Statistics Nigeria, 2012). These surveys provide measures for the three outcomes considered: education, self-employment income and household expenditures. The data collection of GHS survey round in year y is actually carried out early in year $y + 1$, more precisely, typically between February and July of the following year. Therefore, the GHS rounds 2006, 2007 and 2008 with data on the first halves of 2007, 2008 and 2009 are used for the optimization procedure to create the synthetic control region. This procedure creates a synthetic control region that closely corresponds to the Niger Delta region in all outcome variables in 2009 and for a short pre-trend of two years. Earlier rounds are not available. The GHS round 2012 provides data on outcome variables in the first half of 2013 that is used to measure the effects of the peace policy four years later.

Using data from 2013 seems to strike a good balance between capturing meaningful medium-run consequences after peace has been established and not capturing any other effects with the end of the amnesty program in 2015 and heavily increased violent activities due to Boko Haram in some Nigerian states from 2014. The amnesty program established a period of peace in the Niger Delta region lasting at least four years, but it took a year for low levels of violent conflict to materialize. Hence, using data from 2010 that would be alternatively available is likely to be too early and would not capture the arguably more meaningful medium-run outcomes. On the other hand, 2015 is the year when the amnesty program ended, conflict increased to some extent again and some Nigerian states were so badly affected by Boko Haram activities that they may not represent a valid counterfactual any more. Therefore, alternatively available data from 2015 also seems inappropriate.

For measures of conflict, I make use of data provided by the Armed Conflict Location & Event Data Project (ACLED, 2015). This is a very rich data source covering all conflict events with precise location data in many developing states from 1997. In particular, I use the data on Nigeria from 2006 to 2009 for the optimization procedure. In addition, I use conflict data before 2006 and between 2010 and early 2013. The pre-2006 data is used to verify that the conflict development is similar in the synthetic control and Niger-Delta region over a longer time horizon before 2006. The post-2009 data is used to assess whether the synthetic control method indeed produces a counterfactual that displays sustained post-2009 high levels of conflict relative to the Niger Delta region in

which conflict goes down.

4.2 Relevant Measures

As a measure for conflict, I consider fatalities in a conflict event. In particular, I use the sum of fatalities in violent events in a particular state and year as a measure of the degree of conflict. Following the definition of ACLED regarding political violence, I include the following event types: Battles ("Battle – No change of territory", "Battle – Non-state actor overtakes territory", "Battle – Government regains territory"), "Remote violence" and "Violence at civilians". The predominant reason for the inclusion of these events is that they involve violence and variation in the number of fatalities. However, even if other event types are included that are typically associated with no or very few fatalities (e.g. "Strategic development"), the results do not change dramatically.

The main reason for using the sum of fatalities as opposed to other measures of conflict is that it captures both the *extent* and *intensity* of conflict. As a demonstrating example, consider the following two scenarios of conflict a state could undergo: Very few events involving enormous amounts of fatalities vs. an extremely large amount of events with relatively few fatalities each. In my simple categorization, the former is rare, but quite intense conflict while the latter means extensive, but low-intensity conflict. It is unclear whether one scenario represents more conflict than the other or not. Taking the average number of fatalities in an event would, for example, capture only the intensity of conflict, but disregard the extent and give the first scenario a much higher score. Taking the number of incidents as a measure would, on the other hand, capture the extent, but disregard the intensity and give the second scenario a much higher conflict rating. Therefore, it seems reasonable to use the sum of fatalities as a measure in order to capture both elements.

As an education measure, I use a standard measure: Years of schooling. This is observed in great sample size at the state level.

In order to capture overall economic capacity or welfare, I use a measure of household expenditures. Although this does not capture savings, I prefer this measure over household income for several reasons. First, household income is imprecisely measured. For the GHS 2008 survey, the monthly income is only measured in 1000s of NGN (1000 NGN were approximately 6.80 USD in 2009) which – although this seems to be a fairly small inaccuracy in absolute terms – may have non-negligible implications given the fact that 25% of the population report to have an income below 6000 NGN. For the 2012 survey, the income question is on the last payment and not for a specific time period. In light of the high irregularity of income flows that is common for many people in developing countries, it is unclear how informative and accurate such a measure is. Second, key quantiles in the distribution of monthly income and household expenditures in the GHS 2008 survey that are used to create a synthetic control region to the Niger Delta region are very similar. It does not seem to be the case that large amounts of constant saving

disguise the true welfare of household. Third, and relatedly, household expenditures also capture the ability of households to smooth out consumption. While income measures for the last month may be due to high degrees of fluctuation, expenditures are much more smooth and provide a clearer picture of the household's economic welfare situation. Indeed, the distribution of expenditures for the GHS 2008 survey looks considerably more smooth than the one for income.

As another measure of economic activity that may be an important driver of changes in overall economic capacity or welfare, I consider self-employment income on non-farm businesses. As is typical for many developing countries, self-employment activity is of major importance in the economy. In 2012, 62% of workers report being self-employed in a non-farm business while only 11% of workers report working for someone else for a wage. Regarding *income* as a measure as opposed to a mere measure of whether household members own a business or not, this captures the extent of self-employment activity arguably better. It reflects any additional time and effort going into one's business as well as success through a more conducive environment. In addition, it captures an increase in the number of businesses indirectly since this would translate into more competition, crowding-out of low-productivity businesses, and therefore higher income on average.

In order to capture the average in a meaningful way for both household expenditures and self-employment income, I use the median as opposed to the mean for standard reasons.[14] The mean is subject to high volatility for such measures coming from changes in the extreme top part of the distribution. This is a potentially particularly severe issue in my context where I only have data on monthly expenditures and self-employment income in the month preceding the survey interview.

5 Empirical Design

5.1 The Synthetic Control Method

In order to get a valid counterfactual region that the Niger Delta region can be compared to after the policy implementation, I use the same method as Abadie & Gardeazabal (2003) for their investigation of the economic cost of conflict in the Basque region, Spain, in the late 1960s. I construct a synthetic control region from the states that are outside the Niger Delta region and thus unaffected by the policy. There 28 states outside the Niger Delta region (denote the number of non-Niger Delta states $N_{NND} = 28$). The key idea is to use a weighted average of these 28 states that is comparable to the (population weighted) average of the nine Niger Delta states prior to the policy implementation. Since I investigate the impact of the policy on education, household expenditures and self-employment activity, it seems appropriate to make the synthetic control region comparable

[14] While I observe expenditures at the household level, I observe self-employment income at the enterprise level within a household. Most households have one (small) business but around a third have more than one. I therefore consider median household expenditures and median enterprise incomes for states.

to the Niger Delta region in these characteristics before the policy change. I use the data on these outcome variables in all survey rounds up until 2009 for creating the synthetic control region. As an additional characteristic to be similar between the Niger Delta and synthetic control region, I consider conflict for the period between 2006 and 2009.[15]

To introduce some notation for this procedure, let the matrix $\mathbf{X}$ capture the four variables on which the synthetic control region is supposed to closely resemble the Niger Delta region in all available time periods: 2007-2009 measures of education, self-employment income and household expenditures and 2006-2009 measures of conflict. These are 13 variables for each of the 9 states in the Niger Delta region (denote the number of Niger Delta states $N_{ND} = 9$), so $\mathbf{X}$ is of dimension (13×9). Similarly, let the matrix $\mathbf{Y}$ of dimension (13×28) capture the same measures for the 28 states outside of the Niger Delta region.[16] Furthermore, let $\mathbf{v}$ be a (9×1) vector of population weights for the Niger Delta states and $\mathbf{w}$ be a (28×1) vector of *some* weights for the non-Niger Delta states. For the 13 characteristics considered and some vector of weights $\mathbf{w}$, the difference $Xv - Yw$ captures the simple distance between the population weighted average outcome in the Niger Delta region and a $\mathbf{w}$ weighted average of the non-Niger Delta states. The goal of the synthetic control method is to minimize the squared distance by choosing weights $\mathbf{w}$, that is, the optimal weights arise as the solution to the following optimization problem:

$$\begin{aligned} \min_{w} \quad & (\mathbf{Xv} - \mathbf{Yw})'(\mathbf{Xv} - \mathbf{Yw}) \\ \text{s. t.} \quad & w_s \geq 0 \quad \forall s, \\ & \sum_{s=1}^{28} w_s = 1 \end{aligned}$$

where w_s denotes the weight on non-Niger Delta state s. The resulting optimal vector $\mathbf{w}^*$ has non-zero weights for only six of the 28 non-Niger Delta states (denote the number of states in the synthetic control region $N_{SC} = 6$): Abuja (4%), Adamawa (20%), Anambra (12%), Borno (14%), Kogi (27%) and Lagos (23%). The Niger Delta and synthetic control states are displayed in Figure 2.[17]

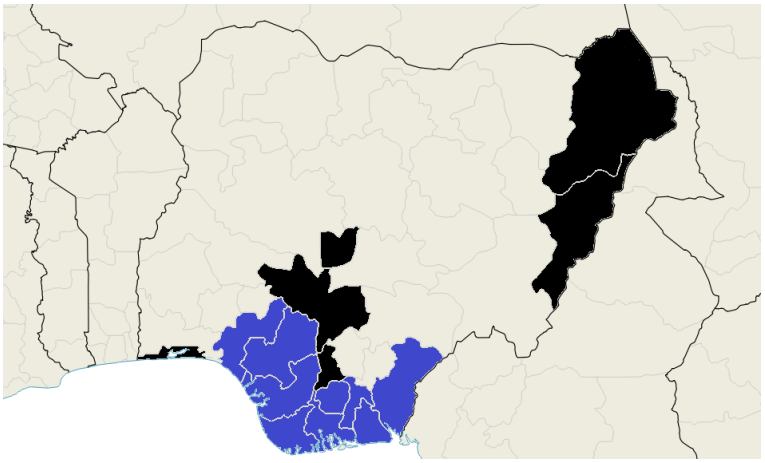
The synthetic control region overcomes the substantial gap between the average of Niger Delta states and an average across all states outside the Niger Delta region before the policy change. A simple comparison between these two regions would be subject to selection bias and lead to overestimation of the effects since the non-Niger Delta states

[15] This period is chosen because it captures the same time horizon as the GHS surveys and because the MEND group, one of the largest militant groups in the Niger Delta, became violently active in 2006 which marks a sharp increase in conflict before the amnesty program was started in 2009.

[16] In order to guarantee comparability in the scale of the different measures, I actually use constructed z scores of each measure by standardizing on the 28 non-Niger Delta control states. However, the non-standardized values are reported for ease of interpretation.

[17] The shares are rounded to the nearest integer. All other states have a weight of zero rounded to the nearest integer. It is not unusual that only a minority of potential control states has a non-zero weight. Abadie & Gardeazabal (2003), Gong & Rao (2016) and Matta et al. (2016) similarly get that only fewer than five control states or countries out of a considerably larger set have non-zero weights. Four out of six states making up the synthetic control region are indeed spatially close to the Niger Delta region. Section 7.2 deals with potential spillover concerns.

Figure 2: Niger Delta and Synthetic Control Region



Note – Niger Delta states are displayed in blue. Synthetic control states are displayed in black.

perform systematically worse than the Niger Delta states in all relevant characteristics. However, the synthetic control constructed using the weights $\mathbf{w}^*$ is comparable to the Niger Delta region. In addition, in order to provide some confidence that $\mathbf{w}^*$ actually provides a valid counterfactual region, I check how it performs on some indicative socio-economic characteristics relative to the Niger-Delta region that can be found in the GHS 2009 survey: Average age, the share of own account workers among all working people as well as the share of individuals with electricity supply, ownership of at least one TV and ownership of at least one mobile phone. Table 1 provides the results for both the variables used in the optimization procedure and further characteristics. Focusing on the period between 2007 and 2009, Figures 4, 5, 6 and 7 display the results for the outcome variables graphically and Figure 3 shows the results for further characteristics.

As the graphs show clearly, the conflict trend between 2006 and 2009 as well as the developments for education, self-employment income and household expenditures in the Niger Delta region are well matched by the synthetic control region. While there are considerable differences between all non-Niger Delta states and the Niger Delta region, the synthetic control region closes this gap.[18] All but one difference are statistically indistinguishable at the 5% level and the magnitudes of differences are usually not very sizeable. As for further characteristics for which the distance between the Niger Delta and synthetic control region is not minimized in the process of the optimization, the synthetic control region still manages to substantially close the gap between the Niger Delta region

[18]It also becomes clear that there is no linear or uni-directional trend for education, self-employment income and household expenditures. There are several important developments that may be reasons for the patterns observed: General elections in 2007, a sharp food price hike in 2008 and the financial crisis in 2008. Multiple channels are conceivable. Sharply increasing food prices from 2007 to 2008 (UNFAO, 2009) may have increased expenditures mechanically, but may also have resulted in substitution away from children's education towards income-generating activity through lower income. The crisis may have hit Nigeria throughout 2008 and resulted in worse economic performance in 2009, in particular in the Niger Delta region suffering from oil price drops (CBN, 2009). The new president's policy may have had its own effect on education and economic performance. Irrespective of what combination of key events or developments may explain these patterns, however, what matters for identification is that the synthetic control region closely corresponds to the Niger Delta region in this trend. This seems to be the case.

Table 1: Synthetic Control Creation Results

	Niger Delta (ND)	non-Niger Delta (p-value Δ ND)	Synthetic Control (p-value Δ ND)
Pre-Policy Outcomes			
Fatalities 2006	2.9	3.2 (n/a)	6.7 (n/a)
Fatalities 2007	16.9	11.7 (n/a)	14.8 (n/a)
Fatalities 2008	16.2	4.4 (n/a)	14.5 (n/a)
Fatalities 2009	163.7	28.7 (n/a)	100.7 (n/a)
Years of Schooling 2007	7.68	6.88 (0.00)	7.89 (0.10)
Years of Schooling 2008	7.28	6.59 (0.00)	7.22 (0.56)
Years of Schooling 2009	7.60	6.85 (0.00)	7.54 (0.48)
Self-emp. Income 2007	72.65	65.52 (0.08)	68.30 (0.35)
Self-emp. Income 2008	107.60	90.32 (0.05)	101.11 (0.59)
Self-emp. Income 2009	94.81	62.98 (0.00)	86.67 (0.10)
HH Expenditures 2007	96.10	69.98 (0.00)	82.76 (0.01)
HH Expenditures 2008	154.61	123.95 (0.00)	166.76 (0.13)
HH Expenditures 2009	100.30	89.00 (0.00)	105.01 (0.08)
Further Characteristics (2009)			
Age	26.0	22.7 (0.00)	24.5 (0.00)
Own Account Workers (%)	71.9	66.1 (0.00)	66.1 (0.00)
Electricity Supply (%)	72.8	50.7 (0.00)	58.6 (0.00)
TV Ownership (%)	19.5	12.0 (0.00)	16.5 (0.00)
Mobile Phone Owner (%)	44.6	29.8 (0.00)	40.6 (0.00)

Note – Both self-employment income and household expenditures are reported in USD. p-values for mean differences with the Niger Delta region are based on two-sided t tests with $\min\{N_{ND}, N_{NND}\} - 1 = 8$ d.o.f. for the difference between Niger Delta and non-Niger Delta states and $\min\{N_{ND}, N_{SC}\} - 1 = 5$ d.o.f. for the difference between Niger Delta and Synthetic Control. Since the measure for conflict is aggregate data on the universe of conflict, typical standard errors are not available.

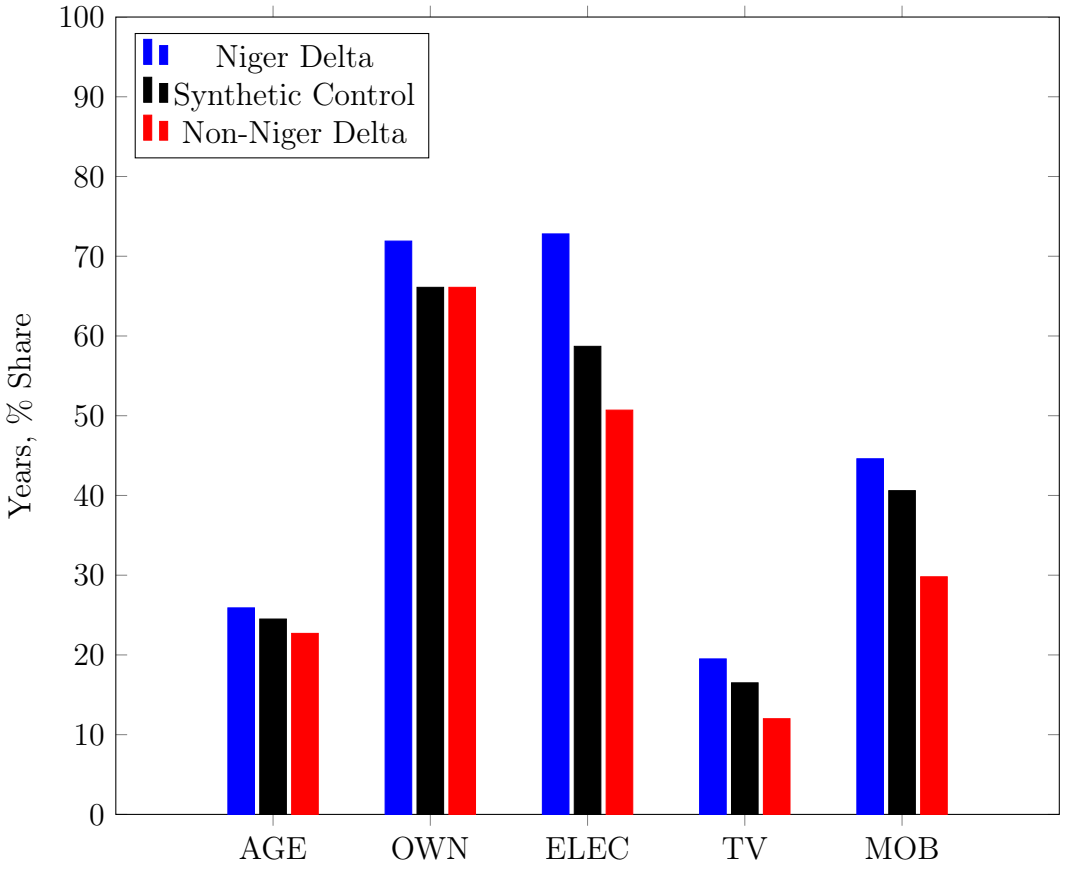
and the simple average of all non-Niger Delta states for most variables.[19] Lastly, it is notable that the pre-2006 conflict trend in the Niger Delta region (which is not part of the optimization) is more closely followed by the synthetic control region than by the trend in all non-Niger Delta states.

5.2 Interpretation and Identification

This analysis takes the unusual approach of evaluating peace in the Niger Delta region relative to continued conflict in other Nigerian states serving as counterfactual. Most studies conversely evaluate either ongoing conflict relative to peace or the consequences of a period of conflict some time after the conflict has ended (with greatly varying time horizons) by comparing areas that were affected by conflict to counterfactual areas that did not experience conflict in the past. I evaluate peace relative to continued conflict

[19] It is indeed true that for all characteristics, the difference between the Niger Delta region and the synthetic control region is still statistically highly significant. However, this is due to the fact that there is a very large number of observations at the individual level for these characteristics and averages are therefore extremely precisely estimated – even small differences, consider for example mean age, would show up statistically highly significant. However, they are not necessarily economically meaningful.

Figure 3: Synthetic Control Creation Results for Further Characteristics



Note – Characteristics are age in years and shares of individuals who are own account workers (among all working people), have electricity supply, own TVs and own mobile phones. All data is from 2009.

because the amnesty policy in the Niger Delta region and conflict in other Nigerian states after 2009 provide a unique (quasi-experimental) setting for this estimation.

Conflict in the period between 2009 and early 2013, especially the later part of this period, happens in a number of Nigerian states mainly – but not exclusively – in the northeastern part of the country.[20] In this sense, the results I find can also be interpreted as the contemporaneous impact of continued conflict in some parts of the Nigeria (represented by the synthetic control region) relative to peace in a comparable Niger Delta region. However, I prefer to interpret them conversely as the benefits of peace in the Niger Delta region relative to what would have happened counterfactually in the same region had the policy not been implemented. This is essentially an estimate of a peace dividend, an evaluation of the potential damage the amnesty policy prevented.

The estimate may even be a lower bound of the true peace dividend since the counterfactual displays (only) sustained levels of conflict which are very comparable to the ones in 2009. It is not clear whether conflict levels would have been sustained or further escalated in the absence of the amnesty policy. Given long underlying tensions and violent conflict that sparked shortly before 2009, it may be reasonable to think that an escalation

[20]For example, the state Borno lies in this part of Nigeria and is one of the states making up the synthetic control region. Conflict in Borno is partly driven by Boko Haram's activities in that region.

of conflict would provide a more realistic counterfactual.

The key identifying assumption for the estimation of the peace dividend is that the Niger Delta region would have had the same development as the synthetic control region after 2009 in the absence of the amnesty policy. Relatedly, one may wonder why an amnesty policy was carried out as a response to conflict in the Niger Delta region and not in other states of Nigeria that experienced ongoing conflict and – more importantly – whether the underlying reasons pose a threat to identification. Clearly, the fact that the Niger Delta region is an oil rich region and that the oil production is a main determinant of the government's fiscal resources plays a role. However, I argue that this is not a concern for bias and internal validity and, if anything, affects external validity.

First of all, any relevant influence of systematic differences in oil production between the Niger Delta region and the synthetic control region should show up in differences in the pre-2009 trend which actually closely resemble each other. Furthermore, oil production decreased in the Niger Delta region before 2009 (Abazie-Humphrey, 2014; OPEC, 2010). Any concern (in the sense of an omitted variable) around oil production picking up before 2009 when the policy happened to be put in place with the implication that observed effects would be confounded with positive effects of already increasing oil production before 2009 is inconsistent with such a decrease. Much to the contrary, it seems likely that the policy was put in place precisely because of massive losses from decreased oil production due to conflict. However, this means that the effects of peace (partly) operate *through* increased oil production after 2009 which is not a source of endogeneity but just a channel through which peace operates.[21] Therefore, my results just provide a reduced-form effect of peace from all possible channels.

Naturally, the Niger Delta's oil richness implies that we may expect peace to generate particularly large benefits in the region. This is an issue of external validity, related to the idea of "site selection" in randomized controlled trials (Allcott, 2015). As a consequence, and as usual, my results should first and foremost be interpreted as the effect generated in the specific context of conflict in the Niger Delta region. To assess to what extent external validity may be compromised, it is then instructive to regard them in light of findings from different settings.

Another identification concern is that the synthetic control method is generally unable to distinguish the effect of the analyzed policy from the potential effect of other policies or developments over the same time horizon in the same area. In this case, the peace effects cannot be isolated from any other political or economic development between 2009 and 2013 that affects the Niger Delta region. One such rather prominent development is the election of President Goodluck Jonathan in 2010 who comes from the Niger Delta region. Given Nigeria's clientelistic nature of government, it is not far-fetched to believe that his policies may have benefited the Niger Delta region relative to other parts of the country

[21] Note that the synthetic counterfactual displays sustained levels of conflict reflecting a counterfactually sustained low oil production. Again, if anything, it seems reasonable to assume that conflict may actually have escalated further and induced further drops in fiscal revenues from oil production, in which case the results are lower bounds.

in the outcomes of interest. While I cannot perfectly exclude any such effects, considering the outcomes in the state Bayelsa that Goodluck Jonathan is from separately from the entire Niger Delta region suggests that this is not a major concern. For all three outcomes, Bayelsa exhibits a lower value in 2013 than the average of the Niger Delta region and the difference is substantial. Furthermore, the development over time in Bayelsa is not better than for the other states of the Niger Delta region. Indeed, while it is comparable for education, it is actually considerably *worse* for self-employment income and household expenditures.

5.3 Differences with Other Approaches

Comparing the synthetic control method to standard regression techniques (involving in particular DID regression methods that are commonly used in the micro-empirical literature on the effects of conflict), three distinct advantages of the former method emerge. First, while it can be shown that a regression-based estimator would essentially also produce a weighted average of potential control states with the weights summing up to one, the weights may lie outside the unit interval (Abadie et al., 2015). Therefore, regression techniques allow for extrapolation and hence potential extrapolation problems whereby the extent of extrapolation is typically unknown to the empirical analyst since the weights are usually not computed in practice.

Second, and especially relevant to this multi-outcome analysis, a regression-based analysis would not produce the *same* counterfactual for all the outcomes while the synthetic control method does and successfully matches not only 2009 outcomes, but also the pre-trend. This may yield more convincing estimates of the causal effects of peace.

Third, the commonly used DID techniques do not allow to control for time-varying fixed effects in different regions while the synthetic control method does.[22] Abadie et al. (2010) prove that the synthetic control method is essentially a generalization of the usual DID model in precisely the way that it allows unobserved characteristics to vary with time.[23] The key common trend assumption in DID analyses which basically assumes away that unobserved characteristics in treatment and control units are time-varying can actually be verified in my data. Since my data allows me to observe how the treatment and control states evolve with regards to the outcomes of interest in the two years preceding the policy implementation in 2009, it can actually be observed how the common trend fails between

[22] While it is possible to control specifically for potentially confounding observable variables (past realizations of outcome variables could for example be controlled for) and hence capture their time-varying effects within regions, this does not solve the problem entirely. First of all, there may still be *unobserved* characteristics that vary in time. In fact, including past outcome variables in the DID regressions that I carried out as robustness checks does not change the results substantially. In addition, this still imposes a linear relationship between the observed control variables that are included while the synthetic control method does not make such a parametric assumption. Finally, including past outcome variables as control variables engenders the standard problem of putting the assumption of no correlation between the error term and regressors at risk since any degree of autocorrelation in the error term would result in a violation of the assumption.

[23] The idea is essentially that the synthetic control method is likely to match time-varying unobserved heterogeneity when it matches a sufficient number of observable characteristics.

2008 and 2009 for self-employment income and household expenditures. The reduction in the former variable is considerably more pronounced in the non-Niger Delta states. It amounts to 27.34 USD in non-Niger Delta states while it is only 12.79 USD in Niger Delta states. Household expenditures show the reverse pattern; they decrease more strongly in Niger Delta states (by 54.31 USD vs. a 34.95 USD reduction in non-Niger Delta states). A close look at the trend in Figures 6 and 7 between 2008 and 2009 identifies this differential pattern graphically. In fact, implementing a simple DID procedure as a robustness check in section 7.1, I show that the DID results deviate from the results coming out of the synthetic control method in exactly the direction of the violations of the common trend assumption.

6 Results

6.1 Conflict Reduction

While the sharp conflict trend was stopped and reversed in the Niger Delta region as a consequence of the policy from 2010, the synthetic control region continues to show high conflict levels after the policy implementation. Figure 4 depicts this relationship very clearly. The synthetic control region maintains high conflict levels relative to both the Niger Delta region and the non-Niger Delta states after the amnesty policy implementation in 2009. Although there is a sharp drop in the synthetic control region in 2010, conflict levels are high again and comparable to the 2009 Niger Delta levels from 2011 to 2013. It is particularly relevant for the peace dividend estimation that conflict levels are very similar in the synthetic control in early 2013 and in the Niger Delta region in 2009 since the estimation is based on outcomes in early 2013. By contrast, the average across all states outside the Niger Delta region does not correspond to these conflict levels.[24]

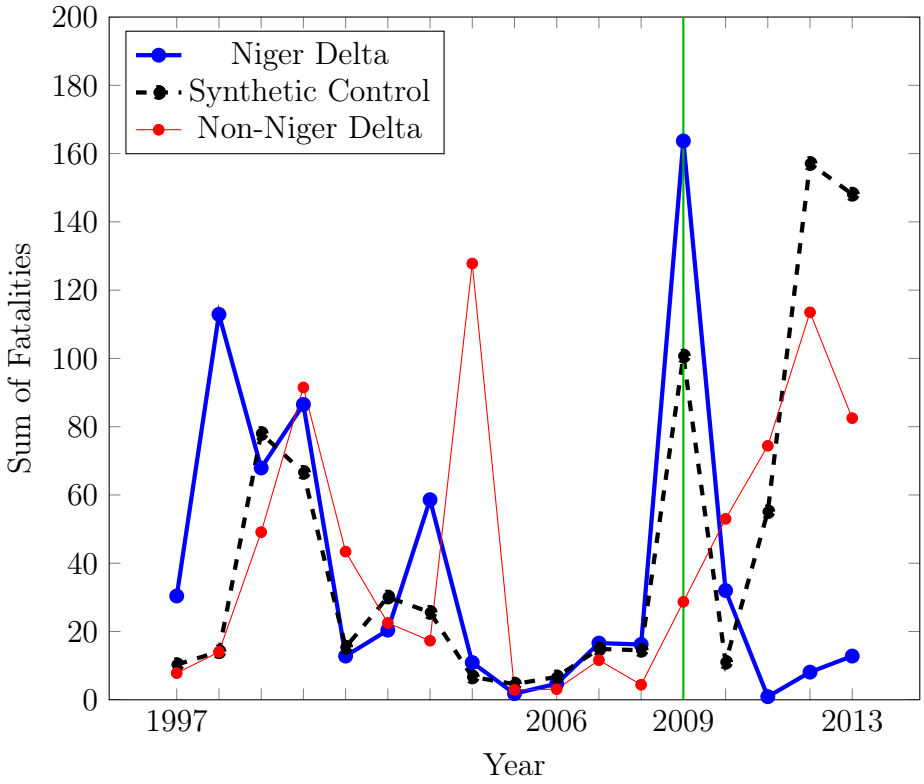
The following analysis estimates the benefits of post-2009 peace in the Niger Delta region. The time series does not conclusively prove but strongly suggest that the amnesty policy played a role in generating peace in the region. Therefore, I interpret the peace dividend as the result of the amnesty policy. This interpretation ceases to hold up if the amnesty policy does not cause peace in the region. Importantly, however, for the estimation of the peace dividend (irrespective of how peace came about), documenting a period of peace between 2009 and 2013 is sufficient.

6.2 Main Results on Economic Outcomes

Comparing the Niger Delta region to its synthetic control region in early 2013, the effect of peace in the Niger Delta region on education, self-employment income and household

[24] Table A1 shows these results formally in a regression. Focusing on the violent period immediately preceding the policy from 2006, I consider both how the fatalities change on average (column 1) and how the trend in violence changes (column 2). There is both a significant reduction in fatalities in the Niger Delta region after 2009 and also a significant trend break with violence increasing up until 2009 and decreasing after.

Figure 4: Conflict Levels Before and After 2009



Note – In 2009, the peace policy was implemented. For 2013, only January to July are included as the data collection for outcome variables in 2013 ended in July.

expenditures is considered in this section. Table 2 and Figures 5 to 7 summarize the main findings.

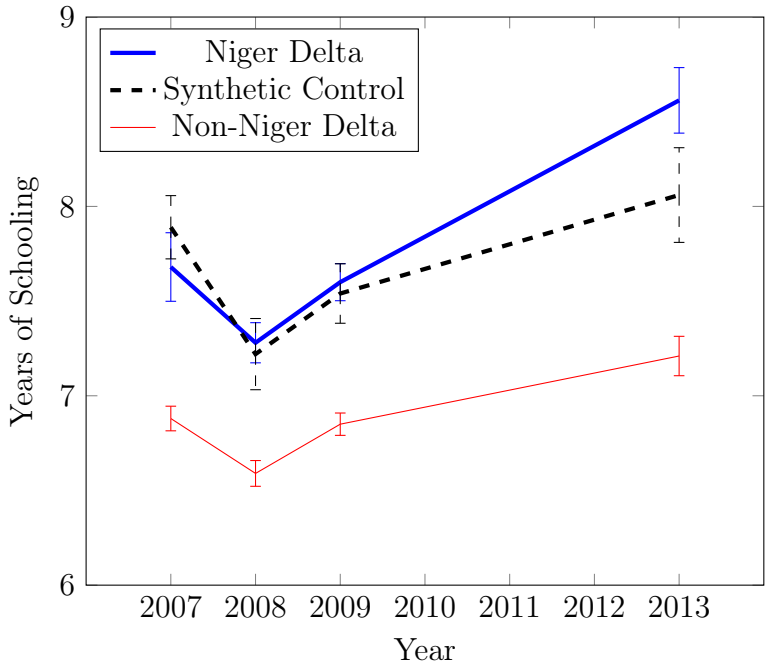
Table 2: Main Results for the Synthetic Control Method (SCM)

	Years of Schooling	Self-emp. Income	HH Expenditures
Niger Delta	8.56	118.25	193.47
	(0.08)	(11.54)	(5.40)
Synthetic Control	8.06	70.75	162.49
	(0.10)	(5.80)	(4.97)
SCM Estimator	0.50***	47.49**	30.98***
	(0.12)	(12.91)	(7.34)

Note – Self-employment income and household expenditures are reported in USD. Standard deviations/errors are reported in parentheses. Standard deviations for median self-employment income and median household expenditures are bootstrapped with 500 replications at the state level. On the basis of one-sided t tests with $\min\{N_{ND}, N_{SC}\} - 1 = 5$ d.o.f., * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The results represent a peace dividend over a period of four years. All results are statistically significant at the 5% level at least. The substantial magnitude of the results suggests that there are considerable benefits from peace or, conversely, severe consequences of conflict. Average education increases by 0.5 years of schooling which is broadly in line with what the literature finds in other countries. Typical estimates range between a

Figure 5: Education Results



Note – Vertical bars indicate 95% confidence intervals.

reduction by 0.2 and 1 year(s) of schooling.[25] According to estimates by Aromolaran (2006) and Schultz (2004), returns to primary and secondary schooling in Nigeria range between 2% and 7% and are even higher for post-secondary education (10%-15.5%).[26] Given these estimates, even if we were to ignore the potentially overestimated returns for post-secondary education which only about 10% of the Nigerian population enjoyed in 2013, an average increase by half a year of schooling has a meaningful long-term economic effect on the labor market.

With regards to both measures for economic activity, I find substantial effects. In the Niger Delta region, self-employment income is 47.49 USD higher than in the synthetic control region at the median and household expenditures exceed its counterfactual by 30.98 USD at the median. The relative effects are enormous. Given the counterfactual median values, these differences represent 67% and 19% increases, respectively.

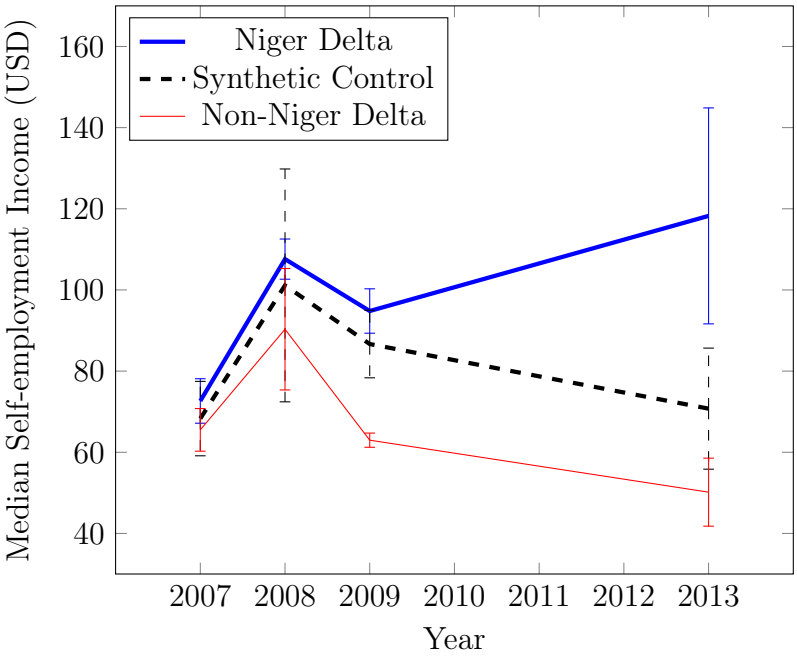
Since the initial levels for both variables are not exactly the same for the Niger Delta and synthetic control region in 2009, one might be concerned about bias of the estimator. However, even if we take the initial differences in 2009 into account and subtract them from the outcome difference in 2013, we would still have sizeable effects. For self-employment income, the effect would be 39.35 USD (or 56%) and it would amount to an increase by 35.69 USD (or 22%) for household expenditures.[27]

[25] This is based on the comprehensive set of studies cited in the introduction.

[26] Even though these authors merely run OLS regressions on household survey data, they argue that the potential upward bias from omitted socio-economic factors may very well be offset by downward bias from measurement error, referring to Card (1999) and Ashenfelter & Krueger (1994). In particular for primary and secondary education, the quality of education measurements in the household surveys would suggest that this is quite likely to be the case or that the bias from measurement error may even be larger in which case, if anything, their return estimates provide lower bounds.

[27] Using the information in Table 1 and 2, $39.35 = 47.49 - (94.81 - 86.67)$ and $35.69 = 30.98 - (100.3 -$

Figure 6: Self-employment Income Results



Note – Vertical bars indicate 95% confidence intervals.

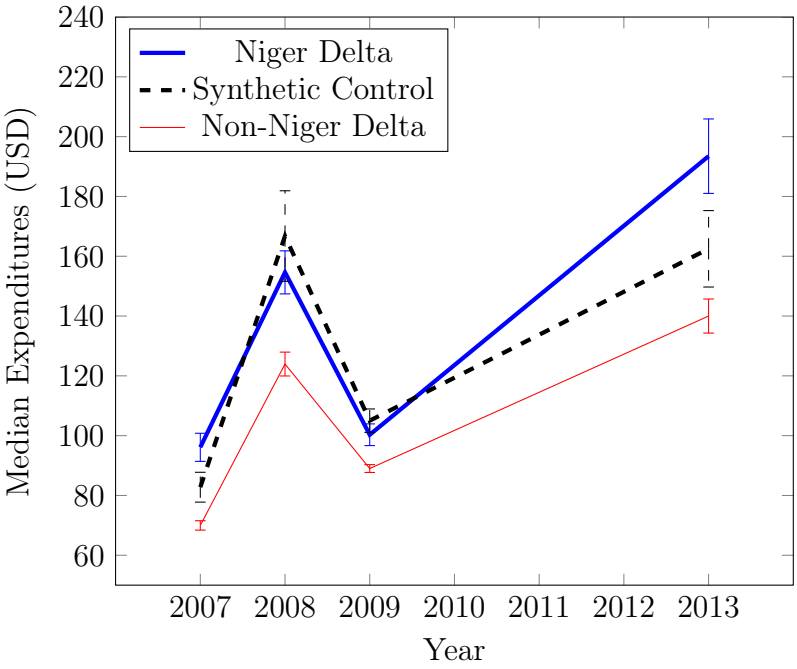
In relation to the existing literature, the results on household expenditures are indeed large but in line with what the most closely comparable literature finds. Studies that exploit the synthetic control method to estimate the effect of conflict on economic performance a couple of years following its onset generally find effects ranging between -5% and -20% (Abadie & Gardeazabal, 2003; Dorsett, 2013; Gong & Rao, 2016; Matta et al., 2016).

Going beyond an estimation of the peace dividend for a measure of households' overall livelihood, my results for self-employment income shed light on an important driving force behind these benefits of peace. The activity of (small) businesses seems to be revitalized. With 62% of workers engaged in self-employment, this is an important economic activity. Yet, the mechanism has been largely overlooked so far. There is one comparable study in Mexico that considers how self-employment income is affected by violent conflict (Velásquez, 2020). She finds considerably smaller effects. However, this is not necessarily surprising as the Niger Delta region is a setting in which we may expect to find large economic benefits for businesses. In the oil-rich region, peace may lead to a quick and strong rebound of business activity in the oil industry and spin-off businesses. Indeed, Walls & During (2020) find that oil production increases by 40% in response to the peace policy in the Niger Delta region. Beyond the oil industry itself, oil and any derivative materials may be key inputs for many other businesses that make use of generators or cars. Therefore, it is entirely plausible that peace has a strong effect on productivity of businesses which translates into increased income.

With regards to the theoretical considerations, the results are in line with what peace

105.01).

Figure 7: Household Expenditures Results



Note – Vertical bars indicate 95% confidence intervals.

is expected to generate. In particular, the effect on household expenditure, taken as a measure of overall economic performance, is strongly positive. Clearly, the medium-run benefits of peace significantly dominate any potential immediate economic losses from diminished militant activity and oil theft. We also observe that the increase in self-employment income are relatively larger than the increase in overall economic performance which may reflect that some labor supply shift from military activity and oil theft into non-farm business activity has indeed taken place. Of course, alternative explanations may be that not all additional income is spent, but part of it is saved, or that self-employment activity has increased relatively more strongly than waged labor supply as a response to peace.

7 Robustness

7.1 Difference-in-differences Estimation

As a first robustness check, I perform a simple difference-in-differences (DID) analysis as an alternative method for the outcomes education, self-employment income and household expenditures. The simple comparison is essentially just a comparison of two differences in means. In regression format, the DID estimator would be the coefficient δ in:

$$y_{it} = \alpha + \beta \mathrm{ND}_i + \gamma \mathrm{T2013}_t + \delta(\mathrm{ND}_i \times \mathrm{T2013}_t) + u_{it}$$

where y_{it} and u_{it} are the outcome and error term in state i and year t respectively, ND_i is a dummy variable indicating whether state i is in the Niger Delta region or not and T2013_t is a dummy taking the value 1 if the year is 2013.[28]

I can demonstrate that the DID results are in line with my previous results for outcomes for which the parallel trend assumption holds and deviate from the results in the expected direction for outcomes for which the pre-2009 trend for the non-Niger Delta states deviates from the Niger Delta and synthetic control region. Table 3 presents the results in the format of simple two-way differences.

Table 3: Difference-in-differences Estimation (DID) Results

	Years of Schooling		Self-emp. Income		HH Expenditures	
	2009	2013	2009	2013	2009	2013
Niger Delta	7.60	8.56	94.81	118.25	100.30	193.47
	(0.04)	(0.08)	(2.37)	(11.54)	(1.58)	(5.40)
non-Niger Delta	6.85	7.21	62.98	50.17	89.00	140.00
	(0.03)	(0.05)	(0.86)	(4.08)	(0.64)	(2.78)
DID Estimator	0.59***		36.24**		42.17***	
	(0.10)		(12.49)		(6.30)	
SCM Estimator	0.50***		47.49**		30.98***	
	(0.12)		(12.91)		(7.34)	
Pre-trend Deviation	0		+		-	

Note – Self-employment income and household expenditures are reported in USD. Pre-trend Deviation is a DID estimator for outcomes between 2008 and 2009. Standard deviations/errors are reported in parentheses. Standard deviations for median self-employment income and median household expenditures are bootstrapped with 500 replications at the state level. On the basis of one-sided t tests with $\min\{N_{ND}, N_{NND}\} - 1 = 8$ d.o.f. for the DID estimator and $\min\{N_{ND}, N_{SC}\} - 1 = 5$ d.o.f. for the SCM estimator, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Comparing them with the results from the synthetic counterfactual procedure, it should first of all be noted that the two estimators are not significantly different for any of the three outcome variables (the lowest p-value on the three difference tests is 0.24 – for median household expenditures). As for education, the difference between the two estimators is very small. This is consistent with the fact that the parallel trend assumption strongly appears to be satisfied. Graphically, Figure 5 demonstrates this clearly.

With regards to self-employment income and household expenditures, however, the fact that the two estimators are statistically indistinguishable may not necessarily be a result of the two estimators in fact coinciding, but of large standard errors. Nevertheless, considering the point estimates, the direction of the DID estimator's deviation is perfectly in line with pre-trend differences between the Niger Delta states and those outside the Niger Delta region. Figures 6 and 7 demonstrate this point graphically. It seems that the

[28] Most DID approaches are finer in the sense that they control for regional fixed effects by taking a dummy variable for each region instead of a coarser distinction between Niger Delta states and non-Niger Delta states only. However, which set of dummies is used does not make a difference for the magnitude of the DID estimator δ. Furthermore, if past values of the outcome variables are included as additional controls, the results do not change much. The simple version of the DID is therefore reported here.

two regions follow a similar trend between 2007 and 2008 and have different trends between 2008 and 2009 – as discussed in section 5.1, the magnitude of these trend deviations is not negligible. Therefore, the direction of the common trend assumption's violation can be well captured by a simple DID estimation between 2009 and 2008. As for median self-employment income, this trend deviation is positive. Therefore, we would expect the DID estimator to underestimate. In the case of median household expenditures, the trend deviation is negative and we would expect the DID estimator to overestimate.[29] Relative to the estimator using the synthetic counterfactual, these are exactly the bias directions that we observe.[30] This should place further confidence in the main results based on the synthetic counterfactual.

7.2 Spillover Effects

Since four of the six states that are part of the synthetic control region are quite close to the Niger Delta region, one might be concerned about spillover effects. Any effect of peace in the Niger Delta region on states outside it would form a violation of the Stable Unit Treatment Value Assumption (SUTVA) and bias the results. There are potential spillover effects in two directions that would bias the results in opposite ways.

First, there may be spillover effects from peace on other states that would form a positive impact on them, for example through increased trade with neighboring states if economic activity improves in the Niger Delta region or through infrastructure extending into neighboring states. Such effects would imply that states outside the Niger Delta region are also "treated" and their outcomes would show up more *positively* than the true counterfactual. Therefore, these effects go against my results and would mean that I underestimate with the true effect being even larger than what I find.

Second, posing more reason for concern, peace may attract people from other states into the Niger Delta region. In this case, outcomes of states outside the Niger Delta region would show up more *negatively* than the true counterfactual and I would overestimate the true effect. Typically, and plausibly, these effects would be stronger for states that are closer to the treatment region which is what I exploit to test for spillover effects.

As a first piece of evidence against the presence (or dominance of) one type of spillovers, consider the above DID results again. The particular spillover concern with the synthetic control region is that four out of the six states that in it are very close to the Niger Delta region. The DID approach, however, takes all 28 non-Niger Delta states as part of the counterfactual. Since spillovers are expected to be stronger in states closer to the treatment region, with sizeable spillovers we would expect the DID results to be

[29] As for education, this way of estimating a pre-trend deviation gives a precisely estimated zero. The estimate is 0.05 ($p = 0.46$).

[30] With regards to the magnitude of bias, the standard errors are very large which makes it impossible to make precise statements as to whether the magnitude of the bias reflects the actual difference observed between the two different estimators. Indeed, the point estimates are close and statistically indistinguishable in both cases. For median self-employment income, the estimator difference is 11.25 and the trend deviation is 14.55; for median household expenditures, the estimator difference is -11.17 and the trend deviation is -19.36.

systematically different from the main results using the synthetic control region. This is not the case. The DID results are not only statistically indistinguishable from the SCM results but the former also deviate from the latter in *different* directions across the outcomes self-employment income and household expenditures. They do not jointly indicate the presence or dominance of one type of spillover. Much rather, as discussed above, these differences can be explained by pre-trend deviations.

Migration flows, taken from the GHS 2012 survey, serve as a second piece of evidence against the presence (or dominance of) one type of spillovers. The particular spillover concern in terms of migration flows is that there may be a large inflow of (especially highly economically contributing) people into the Niger Delta region from the synthetic control region relative to the opposite flow in times of peace or that peace generally attracts in-migration. In this case, states closer to the Niger Delta region should show more migration into that region than states further away. Table 4 demonstrates that both these concerns do not seem to apply.

Table 4: Migration Flows

	Move from SC (Std. Err.)	Move from NS (Std. Err.)	Move from NND (Std. Err.)	Move from ND (Std. Err.)
Move to SC				2.18%
				(0.0023)
Move to NS				0.89%
				(0.0014)
Move to NND	8.99%	12.45%	7.75%	3.05%
	(0.0011)	(0.0012)	(0.0006)	(0.0027)
Move to ND	0.28%	0.40%	0.45%	13.02%
	(0.0011)	(0.0012)	(0.0006)	(0.0027)
Total Migration	11.05%	12.84%	8.20%	16.06%
	(0.0041)	(0.0043)	(0.0018)	(0.0045)

Note – SC: Synthetic Control region; NS: States directly neighboring the Niger Delta region; NND: non-Niger Delta states; ND: Niger Delta region.

In fact, the migration flow of people from synthetic control states into the Niger Delta region is very small in absolute terms and considerably (as well as statistically significantly) lower than the opposite migration flow.[31] In addition, both the migration flow from states directly neighboring the Niger Delta region (NS)[32] and from the synthetic control region into the Niger Delta region are very close to the general migration flow from non-Niger Delta states into the Niger Delta region.[33] Therefore, the data do *not*

[31] The same result holds when comparing the *share of migrants* from the synthetic control region who move into the Niger Delta region and vice versa. Using the information in the table, the share of out-migrants from the synthetic control region moving into the Niger Delta region is $0.28/11.05 = 2.1\%$ while the share of out-migrants from the Niger Delta region moving into the synthetic control region is $2.18/16.06 = 13.6\%$.

[32] These eight states have a common border with at least one of the Niger Delta states and are thus defined to be the neighboring states: Anambra, Benue, Ebonyi, Ekiti, Enugu, Kogi, Ogun, Osun.

[33] If anything, the flow from SC or NS into ND is smaller than the flow from NND into ND but the estimates are statistically indistinguishable. Again, similar results arise when comparing shares of migrants.

suggest that the migration flow from states that are closer to the Niger Delta region is over-representative of the general migration flow into the Niger Delta region which is what we would expect to see if the second type of spillover effects was at play.

8 Conclusion

This study investigates the benefits of peace for education, self-employment income and household expenditures in the Niger Delta region in Nigeria. For the estimation, I make use of the "Presidential Amnesty Program" carried out by the Nigerian government in the region in 2009. The program granted ex-militants pardon as well as money and required them to undergo "Disarmament, Demobilization and Reintegration" in return for surrendering their weapons. It can be viewed as a policy shock and it was followed by a period of regional peace for a few years. This provides a unique setting to estimate a peace dividend by comparing the Niger Delta region to a synthetic within-country counterfactual in the spirit of Abadie & Gardeazabal (2003). The synthetic control region closely resembles the Niger Delta region before 2009 and the estimation results are robust to several checks.

I find that peace in the Niger Delta region resulted in a 19% increase in household expenditures at the median four years later. A key component of this improvement in household livelihoods seems to be revitalized self-employment activity. Over the same time horizon, self-employment income increased by 67% at the median. Education increases by half a year. Beyond being a desirable outcome itself, the education increase also suggests that there are likely positive peace benefits for school-aged people on the labor market in the long run.

The results are to be interpreted as the peace dividend generated by the amnesty policy in the Niger Delta region relative to a counterfactual of sustained conflict in the region. Although suffering from a considerable degree of uncertainty around the point estimates, they may even provide a lower bound to the true effects of peace if we assume (not unrealistically) that violent conflict in the Niger Delta region would not have remained constant, but further escalated in the absence of the amnesty program. The large effects are relevant in Nigeria's current context of continuous violent activities by Boko Haram. They suggest that there are important economic benefits to be reaped from finding a way to sustained peace.

The estimates give us an idea of how large and varied the effects of peace – or conversely, conflict – potentially are for different outcomes of economic importance and provoke two exciting questions for further research. First, what are the consequences of conflict for different elements of economic activity beyond general economic performance? Given the extraordinarily large effect I find for self-employment income and the fact that there is only little research exploring this link, it seems worthwhile trying to dissect effects on overall economic performance into its various components. In addition, the strong results deserve

further research to try and understand precisely why business activity is so strongly linked to conflict and such an important driver of the overall economic effects of it. Second, do these large effects persist long into the future or do affected regions or countries converge back to their non-conflict counterfactual eventually? Although there is some literature exploring effects in the long run, the results are inconclusive. More research employing a broad array of methods including the synthetic control approach that identify both the overall effects and mechanisms in the long run seems necessary to find an answer to this question.

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Appendix

Table A1: Conflict Reduction in the Niger Delta Region

	(1) Fatalities	(2) Fatalities
After 2009	-34.07**	97.09***
	(14.67)	(32.56)
Year		36.66***
		(12.83)
After 2009 × Year		-40.09***
		(13.03)
Constant	44.78***	-59.48**
	(14.46)	(25.69)
N		
R^2	0.0879	0.297

Note – Outcome variable: Fatalities in a violent conflict event involving at least five fatalities. Heteroskedasticity-robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. [Back to main]