Can International Initiatives Promote Peace?

Diamond Certification and Armed Conflicts in Africa

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Abstract

The Kimberley Process Certification Scheme (KPCS) aims to prevent so-called conflict diamonds – diamonds that come from conflict zones – from entering world markets. The scheme works by tracking diamonds and by limiting trade among KPCS members to certified diamonds. This paper studies the scheme's impact on armed conflict in Africa. We exploit grid-cell level variation in the propensity to extract alluvial diamonds, and compare grid cells with and without this propensity before and after the introduction of the KPCS in 2002. Our results show that the KPCS led to a permanent and significant reduction in armed conflict.

Keywords: Armed conflicts, diamonds, Africa, certification schemes, trade restrictions

JEL: D74, F55, F63, O55, Q34

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1 Introduction

Over the past few decades, there has been a rise in international agreements, national regulations, and transparency and certification schemes that aim to address global challenges, such as poverty and vulnerability, climate change, and violent conflicts (e.g. Dragusanu et al., 2014; Christensen et al., 2021).[1] The success of such efforts has been subject to considerable controversy, in part due to a lack of rigorous empirical evidence (Berman et al., 2017; Oya et al., 2017). One recurring concern is that weak governance structures and high levels of corruption may undermine the effectiveness of initiatives to ameliorate social and environmental problems in fragile states. At the same time, these countries are a prime target for many initiatives, as efforts to build state capacity and promote economic development have proven difficult (Page and Pande, 2018; Bandiera et al., 2019).

We examine one of the first international initiatives to prevent the illicit exploitation of natural resources and promote peace: the Kimberley Process Certification Scheme (KPCS). By tracking diamonds and limiting trade to diamonds that are certified, the KPCS aims to prevent so-called conflict diamonds – "rough diamonds used to finance wars against governments"[2] – from entering world markets (e.g. Haufler, 2009). The Kimberley Process was initiated after civil society organizations and the UN called attention to the role of "conflict diamonds" (AKA "blood diamonds") in financing brutal wars in such states as the Democratic Republic of the Congo, Angola, and Sierra Leone in the late 1990s (Bieri, 2015; Haufler, 2009). Conflict diamonds generally constitute alluvial, or secondary, diamonds that are extracted across Africa by individual diggers using simple tools (Rigterink, 2020).[3] Exploiting commodity price changes, past research has shown that alluvial minerals, including diamonds and gold, increase the incidence of violent conflict in Africa (Rigterink, 2020; Blair et al., 2021; Rigterink et al., 2023).

While the KPCS led to a significant increase in official diamond exports in producing countries, its impact on armed conflict in Africa has remained unclear.[4] Stakeholders of the process and case studies have highlighted both achievements and limitations of the KPCS (Smillie, 2005; Haufler, 2009; Smillie, 2014; Bieri, 2015; Engwicht, 2018). For example, critics raise concerns that the KPCS relies on member states' willingness and ability to monitor and enforce the scheme and that the possibility to discipline participants is limited. Empirically, there exists only suggestive evidence, primarily due to data limitations, with Heffernan (2016) observing a conflict-reducing effect and Berman et al. (2017) finding no substantial effect.[5]

[1] For example, according to the International Trade Center's "Standards Map," there are over 300 voluntary sustainability standards alone (https://www.standardsmap.org/).

[2] This is the official definition of conflict diamonds used by the KPCS (link).

[3] Alluvial mining of minerals is widespread in Africa and has increased considerably over the past decades (World Bank, 2019; Girard et al., 2023). In 2017, there were some 10 million artisanal and small-scale miners in Africa, a figure equivalent to 2.4% of the continent's labor force (World Bank, 2019, p.12).

[4] US GAO (2002) provides estimates of African diamond exports before the KPCS. As of 2024, data on the production and trade of rough diamonds must be provided by KP members (Appendix Section A).

[5] Heffernan (2016) studies the impact of the KPCS on armed conflict at the country-level by comparing countries with secondary diamond deposits with a synthetic control group. In the context of Africa, Berman et al. (2017)

To study the causal impact of the KPCS on armed conflicts in Africa, we exploit cross-sectional variation in the propensity for secondary diamond mining within 0.5×0.5 degree grid cells and compare the incidence of armed conflict in grid cells with and without secondary diamond propensity (henceforth diamond and non-diamond grid cells, respectively) over the period 1997 to 2013, accounting for grid-cell and year fixed effects. We use data on diamond propensity from Rigterink (2020) rather than actual mining activities as the latter is likely endogenous to armed conflict and measured with error.[6] Geo-referenced data on armed conflict ("battles") comes from the Armed Conflict Location & Event Data Project (ACLED).

We find a permanent decline in the incidence of armed conflict in diamond grid cells after 2001, when members began implementing the KPCS. As we consider diamond propensity rather than actual diamond mining activities, our estimates can be seen as a lower bound for the true effect. During the first post-KPCS period (2002–2005), the observed decline in the incidence of armed conflict is 5.5 percentage points on average. This suggests an economically large effect given that prior to the KPCS (over the period 1997–2000), 8.6% of grid cells with secondary diamond propensity experienced armed conflict on average. In other words, the KPCS reduced the incidence of armed conflict in these grid cells by more than half.

We are able to address several concerns regarding our identification strategy. First, we show that diverging trends in armed conflict between diamond and non-diamond grid cells only appear after the introduction of the KPCS, not before. Second, we show that our finding is not limited to grid cells located in Angola and Sierra Leone, whose wars ended in 2002. Third, during the time period we consider, several transparency and reporting schemes were put in place that targeted firms engaged in large-scale industrial mining (Berman et al., 2017; Christensen et al., 2023). To rule out that our estimates capture in part the impact of these schemes, we make use of the fact that primary diamonds can be extracted from the host rock only, while alluvial diamonds can also be extracted far away from it, along downstream river segments (for details see Section 2). Reassuringly, we obtain similar estimates when removing grid cells with a propensity for primary diamonds. Fourth, we add several time-varying controls to our baseline specification and additionally include country × year fixed effects. We obtain a similar pattern, and the effect sizes, although somewhat smaller, remain statistically and economically significant. For example, the estimate for the period 2002–2005 suggests a reduction in the incidence of armed conflict by on average 4.5 percentage points (instead of 5.5 percentage points for the baseline specification). Further, we obtain a similar result when drawing on the UCDP/PRIO Armed Conflict Dataset instead of ACLED, and our result is robust to adjusting standard errors in different ways. Finally, we conduct a placebo test. As the KPCS is confined to alluvial diamonds, it should not reduce conflict incidence related to non-

analyze the relationship between mineral prices and conflict. However, their focus is on industrial rather than alluvial mining and a drawback of diamond prices is the substantial variation in quality and type of diamond.

[6] Our approach is similar in spirit to analyses using agricultural suitability rather than agricultural productivity. Early work includes Nunn and Qian (2011) and Alesina et al. (2013).

diamond artisanal and small-scale mining (ASM) activities. To test this, we use newly available data on a grid cell's gold suitability from Girard et al. (2023) and compare grid cells with and without this suitability over time. Note that alluvial gold mining constitutes the main form of alluvial mining in Africa (Girard et al., 2023). We find no differential trend in the incidence of armed conflict in relation to a grid cell's gold suitability, neither before nor after the introduction of the KPCS.

Our paper contributes to several strands in the literature. There is a rich literature on the determinants of violent conflict, particularly studies focusing on Africa (e.g. Michalopoulos and Papaioannou, 2016; Harari and Ferrara, 2018; McGuirk and Burke, 2020; Eberle et al., 2020; McGuirk and Nunn, 2022). Some studies have examined the link between natural resources and conflict, both theoretically and empirically, with more recent work drawing on grid-cell level data (Berman et al., 2017; Rigterink, 2020; Bhattacharyya and Mamo, 2021; Blair et al., 2021; Hodler et al., 2023; Rigterink et al., 2023). We contribute to this literature by documenting that policies have the potential to reduce violent conflicts in fragile states and thus mitigate what has been termed the "natural resource curse."

Our paper also ties into the nascent literature that tries to identify the causal impact of national or international initiatives, including Corporate Social Responsibility (CSR) and sustainability reporting, to mitigate conflict and/or improve the well-being of local communities in developing countries (e.g. Berman et al., 2017; Dragusanu et al., 2022; Baik et al., 2022; Christensen et al., 2023). Berman et al. (2017), focusing on industrial mining, provide some initial evidence that various transparency initiatives may have reduced the link between price spikes and violent conflict in Africa. More recent work, also drawing on fine-grained data, exploits policy changes over time in a difference-in-differences framework. Christensen et al. (2023) document an increase in economic development in African communities close to large resource extraction facilities following a major increase in US Foreign Corruption Regulation enforcement after 2004. Baik et al. (2022) show that after 2014, when the introduction of the US conflict minerals disclosures rule went into effect, conflict incidence declined in African regions covered by the rule.[7] We contribute to this literature by examining a scheme aimed at regulating alluvial rather than industrial mining, which is arguably more difficult to regulate. In addition, any regulation requires at least some involvement by those countries engaged in the production of alluvial diamonds. In this vein, our study is related to work on the importance of domestic regulation in addressing social and environmental issues as countries progress (Jayachandran, 2022) and to a vast literature on corruption in low- and middle-income countries, including studies on interventions by governments to curb corruption (for reviews see Olken and Pande, 2012; Finan et al., 2017). We contribute to this literature by studying a certification scheme that combines domestic and international efforts to reduce illicit

[7] Other work on the Dodd-Frank Act Provision 1502, however, suggests no aggregate effect (albeit localized displacement effects) or an increase in violence (Parker and Vadheim, 2017; Stoop et al., 2018; Bloem, 2023; Chang and Christensen, 2023).

trade in alluvial diamonds.

Finally, and more broadly, our paper is related to the literature that examines whether and how international interventions such as development aid, trade restrictions, and sanctions can promote peace (e.g. Crost et al., 2014; Nunn and Qian, 2014; Beath et al., 2017); for reviews see Hoeffler (2014), Findley (2018), and Morgan et al. (2023).

2 Background

Diamonds are either excavated from their host rock through large, capital-intensive deep-mining operations ("primary diamonds") or they are extracted through labor-intensive, alluvial surface mining operations ("secondary diamonds"). The latter can be found along rivers many kilometers away from their host rock. They are extracted across Africa by individual diggers using simple tools (Rigterink, 2020). In Africa, the first alluvial diamonds and primary diamonds (kimberlite pipes) were discovered in South Africa, near Kimberley, in the late 1860s and 70s (Janse, 2007). Over the next decades, further diamond deposits were discovered in South and Central Africa and, later, in the 1930s and 40s, in East and West Africa (Janse, 1995a,b). In 2000, African countries with mostly deep mining were South Africa, Namibia, Botswana, and Tanzania; in all other diamond-producing countries such as Angola, the Central African Republic, Guinea, and Sierra Leone alluvial mining dominated (US GAO, 2002); further details on the diamond industry are provided in Appendix Section A. As diamonds are small, easily concealed, and extremely valuable, the risk of theft or smuggling is high. Without tamper-proof packaging and a certification system in place, it is difficult to trace the origin of diamonds, especially when diamonds from different sources are mixed (US GAO, 2002).

In the late 1990s, civil society groups and the United Nations increasingly called attention to the role of so-called "blood" or "conflict" diamonds in various brutal wars, such as in the Democratic Republic of the Congo, Angola, Liberia, and Sierra Leone (e.g. Bieri, 2015; Haufler, 2009). The NGOs Global Witness and Partnership for Africa published reports documenting how the illicit sale of rough diamonds had fueled armed conflict in Angola and Sierra Leone, respectively (Global Witness, 1998; Smillie et al., 2000). As a response, in 1998, the UN Security Council banned the trade in diamonds from Angola, unless a certificate confirmed the diamonds originated from areas under the control of the government. Similar sanctions were imposed two years later on Sierra Leone (Wright, 2004). However, these sanctions were not effective, as rebel groups were able to smuggle rough diamonds via neighboring countries, where certificates of origin were not required (Global Witness, 1998; US GAO, 2002).

Continued global concern over "blood diamonds" prompted various stakeholders to act. In May 2000, South Africa, Botswana, and Namibia initiated a first meeting in Kimberley, South Africa, which marked the beginning of the Kimberley Process. The Kimberley Process involved three stakeholders: governments involved in the production, consumption, and trade of diamonds;

NGOs; and industry representatives who were organized under the aegis of the newly founded World Diamond Council (Wright, 2004; Bieri, 2015; Haufler, 2009). The establishment of a certification scheme was backed by the United Nations General Assembly in its Resolution A/RES/55/56 in December 2000. Participants in the Kimberley Process were requested to report on their progress at the next session of the General Assembly. In its Resolution A/RES/56/263, adopted in March 2002, the UN General Assembly urged participants to finalize the certification scheme and to immediately commence with its implementation. Participants in the Kimberley Process met in the same month. A document from the United States General Accounting Office from June 2002 reports that the remaining technical issues regarding implementation were resolved at this meeting. To move ahead with implementation, there was agreement to focus on adopting the scheme at the national level. Furthermore, and importantly, the report confirms that the involved countries pushed for rapid implementation: "Those in a position to issue the Kimberley Process Certificate were asked to do so immediately. All others were encouraged to do so by June 1, 2002" (US GAO, 2002, p. 7). At the next meeting in November 2002, the Kimberley Process Certification Scheme was formally adopted and January 2003 was set as the official starting date.

As Haufler (2009, p. 4) writes, "The Kimberley Process is an industry-based certification scheme wrapped inside an export/import regime that is implemented through domestic legislation in member states. It is designed to track rough diamonds and prevent those from conflict zones from entering legitimate world markets." The KPCS aims to ensure that members trade only with other members. While the scheme as such is voluntary, it creates strong incentives for countries (and firms) to be part of the "club" (Haufler, 2009; Bieri, 2015).[8] Fourteen African countries participated in the KP from the very start: Angola, Botswana, the Central African Republic, the Democratic Republic of the Congo, Ghana, Guinea, Lesotho, Namibia, the Republic of Congo, Sierra Leone, South Africa, Tanzania, Togo, and Zimbabwe (Appendix Tables A2 and A3). This list includes all major diamond-exporting countries (see Appendix Section A).

As mentioned, the KPCS is not an international treaty or agreement. Rather, governments are obliged to implement national legislation to comply with KPCS standards. This has the advantage of making the KPCS standards legally binding in member states and not just a recommendation that industry players are expected to follow. At the same time, however, the KPCS relies on member states' willingness and ability to monitor and enforce the scheme. This has, therefore, raised concerns that the scheme lacks sufficient rigor, particularly in countries with weak governance and high levels of corruption (Smillie, 2005; Haufler, 2009; Smillie, 2014; Bieri, 2015). In addition, the KPCS lacks an institutional set-up. For example, it has no headquarters, no staff, and no budget (Bieri, 2015). There are limited possibilities to discipline participants, and hardly any members have been expelled to date (Smillie, 2005; Haufler, 2009).

In practice, as Engwicht (2018) highlights for the case of Sierra Leone, the actual enforcement

[8] See also the official website of the KPCS (link).

of the scheme may be less crucial to the success of the KPCS, provided governments are able to ensure – via formal or informal means – that diamonds that enter the formal market do not finance rebel groups. If most diamond-producing countries do so successfully, rebel groups will face major challenges in bringing diamonds into the world market.

3 Data

Following recent work (e.g. Michalopoulos and Papaioannou, 2016; Berman et al., 2017), we conduct the analysis at the 0.5 × 0.5 degree grid cell level (approximately 55 km × 55 km at the equator) (Tollefsen et al., 2012). This allows us to circumvent the use of administrative units as the unit of observation, which may be endogenous to conflict (Berman et al., 2017; Rigterink, 2020). The PRIO-GRID cell data include a total of 10,675 grid cells for the African continent. We remove grid cells, mostly coastal and island grid cells, with a land area in the lowest 5th percentile. We also remove grid cells that have missing values for control variables (most of these cells are in the lowest 5th percentile for land area). Our sample thus includes a total of 10,128 grid cells.

Diamond Propensity. We use data on secondary diamond *propensity* from Rigterink (2020) rather than data on deposits. There are two reasons for this. First, artisanal and small-scale mining activities are likely endogenous to armed conflict. Second, data on small-scale mining activities are often inaccurate due to difficulties measuring such activities (Rigterink, 2020). In determining secondary diamond *propensity*, Rigterink (2020) follows a two-step procedure. First, she determines locations with a propensity for primary diamonds. These are locations with kimberlite or lamproite deposits that intersect an archon, an area of particular geological age. Second, to determine whether a grid cell has a propensity for secondary diamonds, she exploits the fact that secondary diamonds are typically found along or near downstream river segments (up to 600km) from a host rock. Drawing on available information on the world's rivers and their flow direction, she identifies the rivers that lie within a 750m radius of a potential host rock and then follows these rivers downstream up to a radius of 600km from the potential host rock to determine the total length in kilometers of relevant river segments in a grid cell.[9] We create a binary variable that equals 1 for grid cells with any such river segment (irrespective of its length), and 0 otherwise. Out of all 10,128 grid cells, 178 (less than 2%) constitute grid cells with a propensity for primary diamonds and 689 (6.8%) constitute grid cells with a propensity for secondary, or alluvial, diamonds. Panel a. of Figure 1 shows the spatial distribution of grid cells with a secondary diamond propensity.

Conflict Data. We draw on the widely used Armed Conflict Location & Event Data Project (ACLED) (Raleigh et al., 2010). ACLED classifies violent events into three subcategories: battles, explosions/remote violence, and violence against civilians. According to the official KP website, "conflict" or "blood" diamonds "are rough diamonds used by rebel movements or their allies to

[9] The 750 meters threshold is based on the largest known kimberlite deposit. If no such river exists, she selects the closest river to a potential host rock. These rivers lie within 5km from a potential host rock.

finance armed conflicts aimed at undermining legitimate governments" (link). Similarly, the United Nations General Assembly understands "conflict diamonds to be rough diamonds which are used by rebel movements to finance their military activities, including attempts to undermine or overthrow legitimate governments."[10] We therefore focus in our analysis on "battles," which are defined as "a violent interaction between two politically organized armed groups at a particular time and location" (ACLED, 2023, p. 8). Conflict events are georeferenced, which allows us to assign conflict events to grid cells. Our main dependent variable is a dummy variable that is equal to 1 for grid cells with at least one battle occurred in a year. Based on this variable, there were a total of 6,546 conflict events between 1997 and 2013. Panel b. of Figure 1 shows the spatial distribution of all battle events reported by ACLED over the period 1997–2013. Appendix Figure A1 displays the total number of armed conflicts by year, as well as the share of grid cells with at least one armed conflict. It documents a decline in armed conflict from the late 1990s to the mid-2000s, followed by an increase in armed conflict, particularly after 2010.

To examine the robustness of our results, we alternatively use information about the total number of fatalities that occurred in a grid cell and year. This variable is highly skewed: 97.54% of all grid cells had zero fatalities over the 1997–2013 period, and the remainder experienced a total of 350,554 fatalities. Furthermore, we draw on a different data source for armed conflicts, the UCDP/PRIO Armed Conflict Dataset, Version 22.1 (Gleditsch et al., 2002; Davies et al., 2022). UCDP also collects data on armed conflicts (state-based armed conflicts, non-state conflicts, and one-sided violence). However, only armed conflicts that resulted in at least 25 combat-related deaths in at least one calendar year in which the conflict took place are considered. Based on UCDP, there were a total of 5,104 such conflict events during our study period (compared to 6,546 based on ACLED.) The pattern over time largely mirrors the pattern based on ACLED (see Appendix Figure A1). A discrepancy occurs after 2010, when ACLED reports a sharper increase in armed conflicts compared to UCDP.

Study Period (1997–2013). The ACLED has been available since 1997. Because 2001 is our reference year, we will focus our analysis on average effects over four-year periods: one four-year period before the introduction of the KPCS (1997–2000) and three four-year periods afterwards (2002–2005, 2006–2009, and 2010–2013). Additionally, we will examine year-to-year changes in armed conflict. For the period 1997–2013, we have a total of 172,176 observations (10,128 grid cells $\times$ 17 years).

Other Data. We determine the distance of a grid cell to the coast based on its geographic center (centroid), and define the distance variable as the log of one plus a grid cell's distance to the coast; grid cells that include a coast are coded 0. We obtain annual grid-cell level data on total precipitation and average temperature from the Global Precipitation Climatology Project, as available from PRIO-GRID 2.0 (link). We also use elevation data at the 15 arc-second level based

[10] United Nations General Assembly Resolution 55/56 (January 29, 2001).

on SRTM X-SAR Digital Elevation Models created by the German Aerospace Center (DLR), the Italian Space Agency (ASI), and NASA/JPL and corrected by Jonathan de Ferranti (link). Elevation and ruggedness are defined as the average elevation and the standard deviation of elevation within each grid cell, respectively. Finally, we use data on a grid cell's suitability for alluvial gold mining from Girard et al. (2023).

4 Empirical Approach

To estimate the causal impact of the KPCS on the incidence of armed conflict in Africa over the period 1997 to 2013, we employ a difference-in-differences strategy. We compare over time the incidence of armed conflict between grid cells with and without secondary diamond propensity, controlling for grid-cell and year fixed effects. We do not distinguish between members and non-members, as KP membership is endogenous. That being said, most major diamond-producing countries in Africa have been KP members from the beginning (Section 2). In addition, KP likely altered diamond production and trade in both member and non-member countries. Because participants in the Kimberley Process were asked to begin with the implementation of the certification scheme in 2002 (compare Section 2), we consider 2002 as the first post-treatment year. More formally, we estimate the following model (baseline specification):

$$Y_{i,t} = \alpha + \sum_{k=1}^{4} \beta_t \left(DiamondPropensity_i * Period_k \right) + \phi_t + \delta_i + \epsilon_{i,t}, \tag{1}$$

where $Y_{i,t}$ is equal to 1 if ACLED reports at least one battle in grid cell i and year t, and zero otherwise. $DiamondPropensity$ is an indicator variable and is equal to 1 for grid cells with a secondary diamond propensity greater than zero. We refer to such grid cells simply as "diamond" grid cells; all other grid cells are "non-diamond" grid cells. $Period_k$ are dummy variables for the periods 1997–2000 (1), 2002–2005 (2), 2006–2009 (3), and 2010–2013 (4), with the omitted year being 2001. We include year fixed effects (ϕ_t) and grid-cell fixed effects (δ_i). We thus control for any changes in conflict over time that are common across grid cells and for any time-constant grid-cell level characteristics such as geographic characteristics. Our coefficients of interest are the β_ts, which measure the average difference in the likelihood of armed conflict between diamond and non-diamond grid cells in each period (i.e. averaged across four years) relative to the year 2001.

To study yearly changes in the incidence of armed conflict over time, we use the following model:

$$Y_{i,t} = \alpha + \sum_{t=1997}^{2013} \beta_t \left(DiamondPropensity_i * Year_t \right) + \phi_t + \delta_i + \epsilon_{i,t}, \tag{2}$$

where $Year_t$ are dummies for each year (with the omitted year being 2001), and all other variables are defined as before.

Our identification strategy requires that, conditional on grid-cell and year fixed effects, a grid cell's propensity for secondary diamonds is not correlated with factors that also may have reduced armed conflict over time. We address concerns about our identification strategy in several ways. First, we examine whether there was a diverging trend between diamond and non-diamond grid cells in relation to armed conflict even prior to 2002. Second, we conduct a range of robustness exercises (see Section 6).

Throughout, we cluster standard errors at the 4×4 degree grid-cell level interacted with the period dummies. In Appendix Table A7 we show that standard errors are similar when we compute Conley (1999) standard errors allowing for spatial correlation within a radius of 100 km, 200 km, or 400 km and allowing for 4 years of serial correlation.

5 Main Results

Figure 2 first presents the share of grid cells with at least one battle by year, separately for diamond and non-diamond grid cells. The figure descriptively documents two facts. First, prior to 2001, diamond grid cells saw on average more armed conflict compared with non-diamond grid cells (8.6% compared to 3.6%; see Appendix Table A4). Second, after 2001, the incidence of armed conflict declined sharply for diamond grid cells while it remained flat for non-diamond grid cells.

Next, we empirically test the impact of the KPCS more rigorously by estimating equations 1 and 2. Figure 3 plots the results. We find no pre-trend prior to 2002 and a statistically significant differential reduction in the incidence of armed conflict from 2002 onward for diamond grid cells. The size of the effect is large: in the first post-KPCS period (2002–2005), the incidence of armed conflict is reduced by 5.5 percentage points on average (see also column (1) of Table 1). Given that 8.7% of diamond grid cells experienced armed conflict pre-KPCS, this estimate implies that after the introduction of the KPCS, the incidence of armed conflict was more than halved in diamond grid cells.

The effect remains strong at 6.5 to 7.2 percentage points on average for the next two periods, 2006–2009 and 2010–2013. If anything, the effect becomes larger. Figure 2 suggests that beginning in the mid-to-late 2000s, the incidence of armed conflict began to increase in non-diamond grid cells relative to diamond grid cells. One possible interpretation, therefore, is that the KPCS effectively and permanently reduced armed conflict in diamond areas, while factors unrelated to alluvial diamond mining later led to an increase in armed conflict in other areas.

6 Robustness

Figure 3 documents the existence of parallel trends prior to the introduction of the KPCS. In the following, we further examine the validity of our identification strategy and the robustness of our results. The first set of robustness analyses is reported in columns (2) to (6) of Table 1; column (1) displays the result from the baseline specification. The yearly estimates are reported in Appendix Table A6.

We first examine the extent to which the observed effect is driven by Angola and Sierra Leone. The wars in Angola and Sierra Leone ended in 2002. At the same time, these are countries with substantial alluvial mining, and diamonds are considered to have played an important role in both wars (Global Witness, 1998; Smillie et al., 2000; US GAO, 2002). In column (2), we therefore remove from our sample all grid cells located in these two countries. As in column (1), we observe no pre-trend. Starting in 2002, the incidence of armed conflict across diamond and non-diamond grid cells diverges, as diamond grid cells experience a relative reduction in conflict. Yet the coefficient estimates are smaller compared to those reported in column (1). The estimate for the 2002–2005 period (significant at the 10% level) suggests that about half of the effect reported in column (1) comes from grid cells in Angola and Sierra Leone. For the periods 2006–2009 and 2010–2013, we obtain an estimate of 4.0 and 4.5 percentage points (significant at the 1% level), respectively. Overall, the KPCS contributed to an economically significant reduction in armed conflict, including outside Angola and Sierra Leone.

Over the considered time period, several transparency schemes and national regulatory acts were initiated to regulate the mining sector (Berman et al., 2017; Christensen et al., 2023). Two such measures were launched around the same time as the KPCS. The International Council on Mining and Metals (ICMM, https://www.icmm.com/), which promotes CSR reporting, was created in 2001 (Berman et al., 2017). Furthermore, beginning in 2004 the US started to enforce the Foreign Corrupt Practices Act (FCPA) (Christensen et al., 2023). One concern is therefore that our estimates may be distorted by the (potential) impact these initiatives had on armed conflict. To address this concern, we use the fact that both measures target industrial rather than alluvial mining. Thus, we drop grid cells with a propensity for primary diamonds. While we obtain somewhat smaller estimates compared to those based on our baseline specification, the estimated effect remains large at 4.4 to 6.0 percentage points; see column (3) of Table 1.

A further concern is that diamond and non-diamond grid cells may differ with regard to other characteristics and that changes in the frequency of armed conflict over time may be related to these factors rather than secondary diamond propensity. We therefore assess the robustness of our results to the inclusion of time-varying controls. In column (4), we add total annual precipitation, annual precipitation squared, average annual temperature, and average annual temperature squared, as past work has shown that climatic conditions may fuel violent conflict (e.g. Harari and Ferrara, 2018; Eberle et al., 2020; Fetzer, 2020). We additionally interact a county's latitude, longitude, elevation, ruggedness, and distance to the coast – all time-invariant controls – with year fixed effects to allow the influence of these variables on conflict to vary over time. Our estimates change only marginally. In column (5), we additionally add country $\times$ year fixed effects in order to allow for differential trends in the incidence of armed conflict across countries over time. Adding these fixed effects implies that only countries with within-country variation in diamond propensity (26 in total) contribute to the analysis. Our estimates become smaller but remain large at 4.5 and 3.7 percentage points for the first and second post-KPCS period, respectively.

Next, we examine whether we obtain similar results when we draw on the UCDP/PRIO Armed Conflict Dataset to determine the incidence of armed conflict at the grid-cell and year level. Appendix Figure A2 shows descriptively a sharp decline in armed conflict for diamond but not for non-diamond grid cells after the KPCS was introduced. In column (6) of Table 1, we report the regression results. They are remarkably similar to those obtained using ACLED both qualitatively and quantitatively. For example, we obtain a reduction in armed conflict of 5.1 percentage points for the first post-KPCS period (2002–2005), compared to 5.5 percentage points when using the ACLED dataset. The fact that the estimates on the different post-KPCS periods are somewhat smaller is not surprising given UCDP's fatality threshold, which leads UCDP to count fewer armed conflicts than ACLED. Accordingly, only 6.7% of diamond grid-cells experienced armed conflict prior to the introduction of the KPCS based on UCDP/PRIO (compared to 8.7% based on ACLED).

We also consider fatalities as an alternative outcome. We draw on ACLED to determine the number of fatalities in grid cell i and year t. Because 97.35% of all grid cells have zero fatalities over the study period, we use either the natural log of one plus the total number of fatalities (Table A8) or the inverse hyperbolic sine (IHS) transformation of the total number of fatalities (Table A9) as the dependent variable. Overall, we obtain a similar pattern, but note that this model mostly captures the extensive margin effect rather than the intensive margin effect.

Finally, we conduct a placebo test. The KPCS aims to limit trade to certified alluvial diamonds to prevent rebel groups from financing their military activities through rough diamonds. The KPCS should, therefore, not alter the incidence of armed conflict related to non-diamond artisanal and small-scale mining. As artisanal gold mining is the most common form of alluvial mining in Africa, we focus on gold using new grid-cell level data from Girard et al. (2023). Based on this data, there are a total of 4,405 cells with a suitability for alluvial gold mining; 485 cells are suitable for both alluvial gold and diamond mining. Appendix Figure A3 shows descriptively that after the KPCS was introduced, the trend in the incidence of armed conflict remained similar for grid cells with and without gold suitability. As a more formal test, we reestimate our baseline specification but add interaction terms between the period dummies and a dummy for grid cells with alluvial gold suitability. Figure 4 plots the estimates on these interaction terms. It shows that there is no differential trend in the incidence of armed conflict for gold suitability cells prior to the KPCS as well as following its introduction in 2002.[11] Thus, the impact of the KPCS is specific to alluvial diamond mining.

Overall, the various exercises lend credibility to our identification strategy and to the robust-

[11] As a result, the estimates for the differential effect of the KPCS on diamond grid cells are very similar to our baseline estimates; see Appendix Table A10.

ness of our result.

7 Conclusion

We study the impact of the Kimberley Process Certification Scheme (KPCS) on armed conflict in Africa. We find that the KPCS significantly and permanently reduced the incidence of armed conflict in grid cells with secondary diamond propensity compared with those without secondary diamond propensity (relative to 2001), controlling for grid-cell and year fixed effects. For the first post-KPCS period (2002–2005), we document a reduction in the incidence of armed conflict by 5.5 percentage points on average. This represents more than a halving of the frequency of armed conflict that occurred in grid cells with secondary diamond propensity prior to the KPCS.

Our main result is robust to a series of sensitivity checks. For example, we rule out that the decline in armed conflict that we attribute to the introduction of the KPCS captures in part the impact of other major changes over time. We also address potential concerns about omitted variables by extending our baseline specification to include a set of time-varying controls and country $\times$ year fixed effects.

By documenting that the KPCS promoted peace on the African continent, we add to the nascent literature that empirically shows that international agreements, national regulations, as well as transparency and certification schemes can be effective even in countries with weak governance (Berman et al., 2017; Baik et al., 2022; Christensen et al., 2023). Over time, critics have called out the KPCS for its narrow definition of conflict diamonds, which is limited to violence by rebel groups while excluding other forms of violence such as military violence and violations of human rights or workers' rights (Engwicht, 2018). The future will reveal whether the KPCS or other schemes will be able to address these issues.

References

ACLED (2023): "Codebook," Armed Conflict Location & Event Data Project.

Alesina, A., P. Giuliano, and N. Nunn (2013): "On the Origins of Gender Roles: Women and the Plough," *The Quarterly Journal of Economics*, 128, 469–530.

Baik, B., O. Even-Tov, R. Han, and D. Park (2022): "The Real Effects of Conflict Minerals Disclosures," *Working Paper*.

Bandiera, O., M. Callen, K. Casey, E. L. Ferrara, C. Landais, and M. Teachout (2019): "State Effectiveness," IGC Evidence Paper.

Beath, A., F. Christia, and R. Enikolopov (2017): "Can Development Programs Counter Insurgencies? Evidence from a Field Experiment in Afghanistan," *MIT Political Science Department Research Paper No. 2011-14*.

Berman, N., M. Couttenier, D. Rohner, and M. Thoenig (2017): "This Mine Is Mine! How Minerals Fuel Conflicts in Africa," *American Economic Review*, 107, 1564–1610.

Bhattacharyya, S. and N. Mamo (2021): "Natural Resources and Conflict in Africa: What Do the Data Show?" *Economic Development and Cultural Change*, 69, 903–950.

Bieri, F. (2015): *Kimberley Process*, John Wiley & Sons, Ltd.

Blair, G., D. Christensen, and A. Rudkin (2021): "Do Commodity Price Shocks Cause Armed Conflict? A Meta-Analysis of Natural Experiments," *American Political Science Review*, 115, 709–716.

Bloem, J. R. (2023): "Good Intentions Gone Bad? The Dodd-Frank Act and Conflict in Africa's Great Lakes Region," *Economic Development and Cultural Change*, 71, 621–666.

Chang, S. and H. B. Christensen (2023): "Nothing Gold Can Stay: Artisanal Mine Certifications and Conflict Dynamics in the Congo," *Becker Friedman Institute for Economics Working Paper No. 2023-144*.

Christensen, H. B., L. Hail, and C. Leuz (2021): "Mandatory CSR and Sustainability Reporting: Economic Analysis and Literature Review," *Review of Accounting Studies*, 26, 1176–1248.

Christensen, H. B., M. Maffett, and T. Rauter (2023): "Reversing the Resource Curse: Foreign Corruption Regulation and the Local Economic Benefits of Resource Extraction," *American Economic Journal: Applied Economics, forthcoming*.

Conley, T. G. (1999): "GMM Estimation with Cross Sectional Dependence," *Journal of Econometrics*, 92, 1–45.

Crost, B., J. Felter, and P. Johnston (2014): "Aid under Fire: Development Projects and Civil Conflict," *American Economic Review*, 104, 1833–56.

Davies, S., T. Pettersson, and M. Öberg (2022): "Organized Violence 1989–2021 and Drone Warfare," *Journal of Peace Research*, 59, 593–610.

Dragusanu, R., D. Giovannucci, and N. Nunn (2014): "The Economics of Fair Trade," *Journal of Economic Perspectives*, 28, 217–36.

Dragusanu, R., E. Montero, and N. Nunn (2022): "The Effects of Fair Trade Certification: Evidence from Coffee Producers in Costa Rica," *Journal of the European Economic Association*, 20, 1743–1790.

Eberle, U. J., D. Rohner, and M. Thoenig (2020): "Heat and Hate: Climate Security and Farmer-Herder Conflicts in Africa," *CEPR Working Paper 15542*.

Engwicht, N. (2018): "The Local Translation of Global Norms: The Sierra Leonean Diamond Market," *Conflict, Security & Development*, 18, 463–492.

Fetzer, T. (2020): "Can Workfare Programs Moderate Conflict? Evidence from India," *Journal of the European Economic Association*, 18, 3337–3375.

Finan, F., B. Olken, and R. Pande (2017): "Chapter 6 – The Personnel Economics of the Developing State," in *Handbook of Economic Field Experiments*, ed. by A. V. Banerjee and E. Duflo, North-Holland, vol. 2, 467–514.

Findley, M. G. (2018): "Does Foreign Aid Build Peace?" *Annual Review of Political Science*, 21, 359–384.

Gilmore, E., N. P. Gleditsch, P. Lujala, and J. K. Rød (2005): "Conflict Diamonds: A New Dataset," *Conflict Management and Peace Science*, 22, 257–272.

Girard, V., T. Molina-Millán, and G. Vic (2023): "Artisanal Mining in Africa," *NOVAFRICA Working Paper 2201*.

Gleditsch, N. P., P. Wallensteen, M. Eriksson, M. Sollenberg, and H. Strand (2002): "Armed Conflict 1946-2001: A New Dataset," *Journal of Peace Research*, 39, 615–637.

Global Witness (1998): *A Rough Trade: The Role of Companies and Governments in the Angolian Conflict*, Global Witness.

Harari, M. and E. L. Ferrara (2018): "Conflict, Climate, and Cells: A Disaggregated Analysis," *The Review of Economics and Statistics*, 100, 594–608.

Haufler, V. (2009): "The Kimberley Process Certification Scheme: An Innovation in Global Governance and Conflict Prevention," *Journal of Business Ethics*, 89, 403–416.

Heffernan, I. (2016): "Peace Diamonds: Combating Civil War With a Diamond Certification Scheme," *mimeo*.

Hodler, R., P. Schaudt, and A. Vesperoni (2023): "Mining for Peace," CESifo Working Paper Series 10207, CESifo.

Hoeffler, A. (2014): "Can International Interventions Secure the Peace?" *International Area Studies Review*, 17, 75–94.

Janse, A. B. (1995a): "A History of Diamond Sources in Africa: Part I," *Gems & Gemology*, 31, 228–255.

——— (1995b): "A History of Diamond Sources in Africa: Part II," *Gems & Gemology*, 32, 2–30.

——— (2007): "Global Rough Diamond Production Since 1870," *Gems & Gemology*, 43, 98–119.

Jayachandran, S. (2022): "How Economic Development Influences the Environment," *Annual Review of Economics*, 14, 229–252.

McGuirk, E. and M. Burke (2020): "The Economic Origins of Conflict in Africa," *Journal of Political Economy*, 128, 3940–3997.

McGuirk, E. F. and N. Nunn (2022): "Transhumant Pastoralism, Climate Change and Conflict in Africa," *mimeo*.

Michalopoulos, S. and E. Papaioannou (2016): "The Long-Run Effects of the Scramble for Africa," *American Economic Review*, 106, 1802–48.

Morgan, T. C., C. Syropoulos, and Y. V. Yotov (2023): "Economic Sanctions: Evolution, Consequences, and Challenges," *Journal of Economic Perspectives*, 37, 3–30.

Nunn, N. and N. Qian (2011): "The Potato's Contribution to Population and Urbanization: Evidence From A Historical Experiment," *The Quarterly Journal of Economics*, 126, 593–650.

——— (2014): "US Food Aid and Civil Conflict," *American Economic Review*, 104, 1630–66.

Olken, B. A. and R. Pande (2012): "Corruption in Developing Countries," *Annual Review of Economics*, 4, 479–509.

Oya, C., F. Schaefer, D. Skalidou, C. McCosker, and L. Langer (2017): "Effects of Certification Schemes for Agricultural Production on Socio-Economic Outcomes in Low- and Middle-Income Countries: A Systematic Review," *Campbell Systematic Reviews*, 13, 1–346.

Page, L. and R. Pande (2018): "Ending Global Poverty: Why Money Isn't Enough," *Journal of Economic Perspectives*, 32, 173–200.

Parker, D. P. and B. Vadheim (2017): "Resource Cursed or Policy Cursed? US Regulation of Conflict Minerals and Violence in the Congo," *Journal of the Association of Environmental and Resource Economists*, 4, 1–49.

Raleigh, C., A. Linke, H. Hegre, and J. Karlsen (2010): "Introducing ACLED: An Armed Conflict Location and Event Dataset," *Journal of Peace Research*, 47, 651–660.

Rigterink, A. S. (2020): "Diamonds, Rebel's and Farmer's Best Friend: Impact of Variation in the Price of a Lootable, Labor-intensive Natural Resource on the Intensity of Violent Conflict," *Journal of Conflict Resolution*, 64, 90–126.

Rigterink, A. S., T. Ghani, J. S. Lozano, , and J. N. Shapiro (2023): "Mining Competition and Violent Conflict in Africa: Pitting Against Each Other," *ESOC Working Paper 35.*

Smillie, I. (2005): *The Kimberley Process Certification Scheme for Rough Diamonds*, Overseas Development Institute (odi).

——— (2014): *Diamonds*, Polity Press.

Smillie, I., L. Gberie, and R. Hazleton (2000): *The Heart of the Matter: Sierra Leone, Diamonds and Human Security (Complete Report)*, Partnership Africa Canada.

Spar, D. L. (2006): "Markets: Continuity and Change in the International Diamond Market," *Journal of Economic Perspectives*, 20, 195–208.

Stoop, N., M. Verpoorten, and P. van der Windt (2018): "More Legislation, More Violence? The Impact of Dodd-Frank in the DRC," *PLOS ONE*, 13, 1–19.

The Economist (2007): "Changing Facets," published on 22.02.2007.

Tollefsen, A. F., H. Strand, and H. Buhaug (2012): "PRIO-GRID: A unified spatial data structure," *Journal of Peace Research*, 49, 363–374.

US GAO (2002): "International Trade: Critical Issues Remain in Deterring Conflict Diamond Trade," United States General Accounting Office (US GAO).

World Bank (2019): "State of the Artisanal and Small-scale Mining Sector 2019," World Bank (Washington, DC).

Wright, C. (2004): "Tackling Conflict Diamonds: The Kimberley Process Certification Scheme," *International Peacekeeping*, 11, 697–708.

Figures

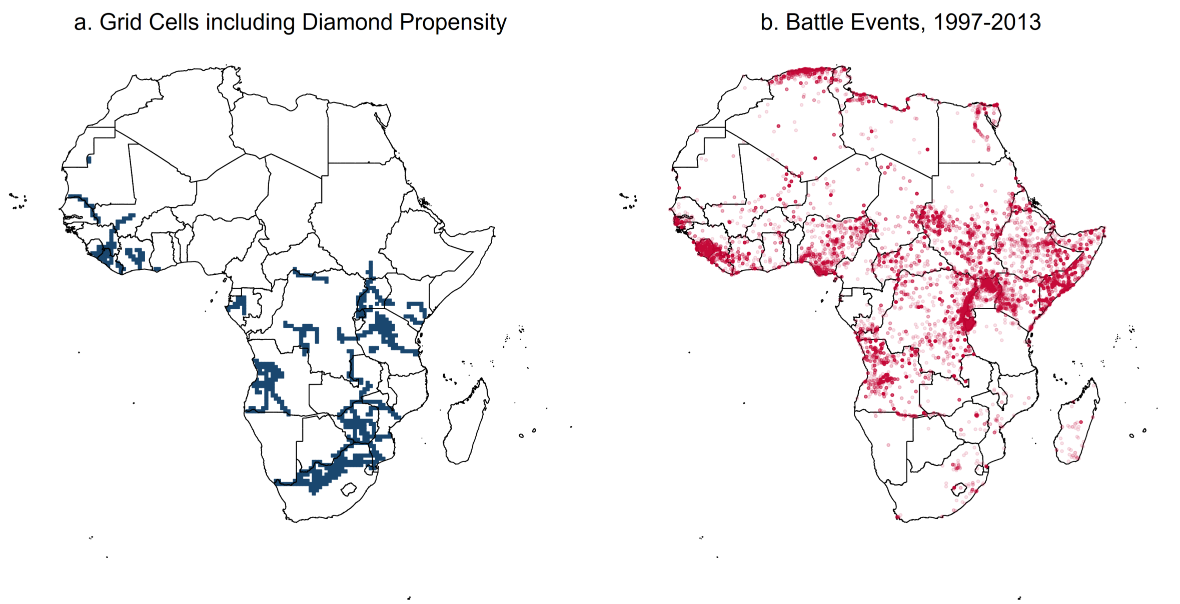

Figure 1: Spatial Pattern of Secondary Diamond Propensity and Armed Conflicts

Notes: The figure displays in Panel a. the spatial distribution of grid cells with secondary diamond propensity and in Panel b. the spatial distribution of all battle events reported by ACLED over the period 1997–2013 (georeferenced). The black lines indicate country borders.

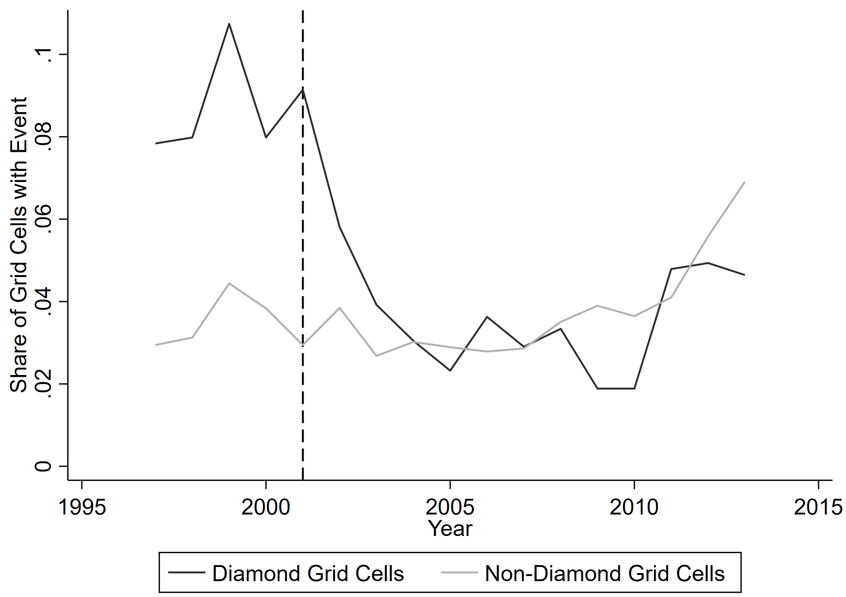

Figure 2: Armed Conflicts in Diamond and Non-Diamond Grid Cells

Notes: This figure shows, by year, the share of grid cells with and without secondary diamond propensity for which the Armed Conflict Location & Event Data Project (ACLED) reported at least one battle event.

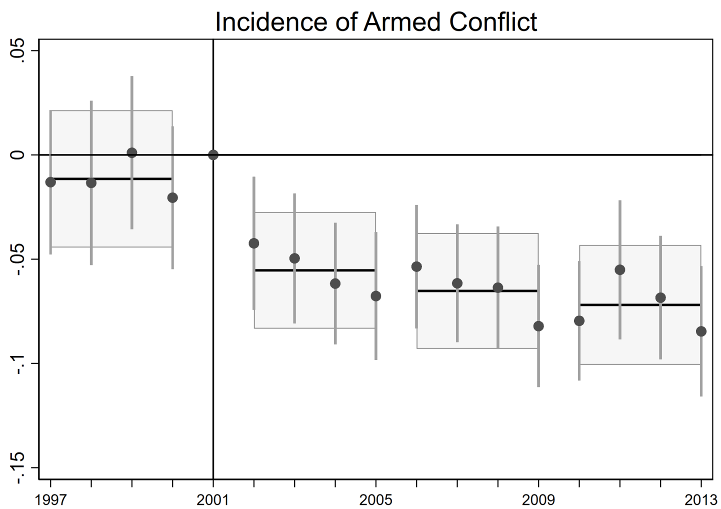

Figure 3: The Effect of the Kimberley Process on Armed Conflicts

Notes: This figure plots the difference-in-differences estimates on the interactions between a dummy for grid cells with secondary diamond propensity and period fixed effects (1997–2000, 2002–2005, 2006–2009, and 2010–2013) as horizontal lines with their 90% confidence intervals indicated as boxes. The regression is estimated at the PRIO-GRID cell level and includes grid-cell and year fixed effects, with the omitted year being 2001; see column (1) of Table 1. It also shows the point estimates from a yearly model as dots with their 90% confidence intervals indicated with vertical lines; see column (1) of Appendix Table A6. The dependent variable is an indicator variable equal to 1 if, according to ACLED, at least one battle occurred in grid cell i and year t, and 0 otherwise. Standard errors are clustered at the 4×4 degree grid-cell level interacted with the period dummies. (Conley standard errors are reported in column (1) of Appendix Table A7.)

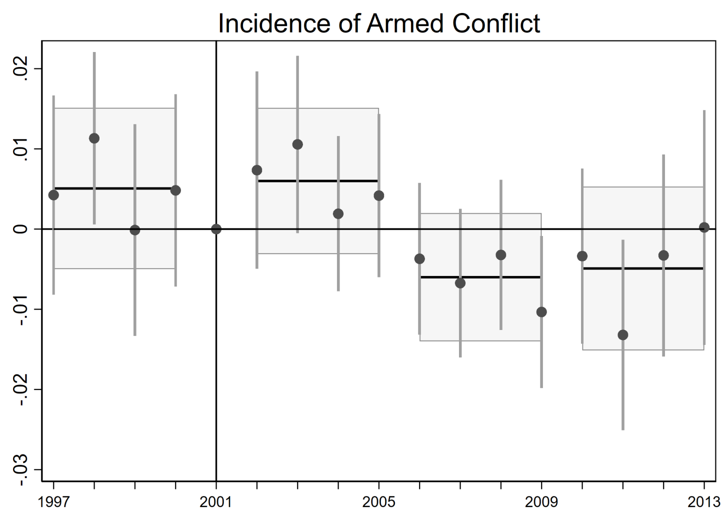

Figure 4: The Kimberley Process, Gold Suitability, and Armed Conflicts: A Placebo Test

Notes: This figure plots the difference-in-differences estimates on the interactions between a dummy for grid cells with gold propensity and period fixed effects (1997–2000, 2002–2005, 2006–2009, and 2010–2013) as horizontal lines with their 90% confidence intervals indicated as boxes. The regression is estimated at the PRIO-GRID cell level. It includes interactions between a dummy for grid cells with secondary diamond propensity and period fixed effects as well as grid-cell and year fixed effects, with the omitted year being 2001; see column (1) of Appendix Table A10. It also shows the point estimates from a yearly model as dots with their 90% confidence intervals indicated with vertical lines. The dependent variable is an indicator variable equal to 1 if, according to ACLED, at least one battle occurred in grid cell i and year t, and 0 otherwise. Standard errors are clustered at the 4×4 degree grid-cell level interacted with the period dummies.

Tables

Table 1: The Effect of the Kimberley Process on Armed Conflicts: Robustness

	Incidence of Armed Conflict					
			ACLED			UCDP
	(1)	(2)	(3)	(4)	(5)	(6)
Diamonds X Pre (1997-2000)	-0.011	-0.018	-0.006	-0.017	-0.018	-0.017
	(0.020)	(0.013)	(0.015)	(0.018)	(0.014)	(0.020)
Diamonds X Post1 (2002-2005)	-0.055***	-0.028**	-0.044***	-0.049***	-0.045***	-0.051***
	(0.017)	(0.014)	(0.013)	(0.016)	(0.012)	(0.017)
Diamonds X Post2 (2006-2009)	-0.065***	-0.040***	-0.054***	-0.056***	-0.037***	-0.063***
	(0.017)	(0.013)	(0.012)	(0.015)	(0.012)	(0.018)
Diamonds X Post3 (2010-2013)	-0.072***	-0.045***	-0.060***	-0.059***	-0.029**	-0.070***
	(0.017)	(0.013)	(0.013)	(0.016)	(0.012)	(0.018)
Excl. Cells in Angola & Sierra Leone	No	Yes	No	No	No	No
Excl. Cells with Industrial Mining	No	No	Yes	No	No	No
Basic Time-Varying Controls	No	No	No	Yes	Yes	No
Country-Year Fixed Effects	No	No	No	No	Yes	No
Observations	172,176	169,150	164,713	172,176	172,176	172,176
R^2	0.307	0.308	0.319	0.312	0.341	0.313

Notes: Difference-in-differences estimates on the interactions between a dummy for grid cells with secondary diamond propensity and period fixed effects. The omitted year is 2001. The dependent variable is an indicator variable equal to 1 if at least one battle occurred in grid cell i and year t, and 0 otherwise. The regressions are estimated at the PRIO-GRID cell level and include grid-cell and year fixed effects. In column (1), we report the estimates from our baseline specification (equation 1). In column (2), we drop grid cells from the sample that are located in Angola or Sierra Leone. In column (3), we remove from the sample grid cells with primary diamond propensity. In column (4), we add total annual precipitation and average annual temperature (linear and squared terms) as well as interactions between latitude, longitude, elevation, ruggedness, and distance to the coast and year fixed effects. In column (5), we additionally add country $\times$ year fixed effects. Standard errors are clustered at the 4$\times$4 degree grid-cell level interacted with the period dummies. In column (6), we use the UCDP/PRIO Armed Conflict Dataset to determine the incidence of conflict. For Conley standard errors, see Appendix Table A7. The yearly estimates are reported in Appendix Table A6. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Appendix

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A Further Background on the Diamond Industry

Until 1960, nearly all diamonds worldwide were produced in Africa (Janse, 1995a, 2007). In the following decades, several non-African countries became important producers: Russia (starting in 1960), Australia (starting in 1979), and Canada (starting in 1998) (Janse, 2007). The diamond industry has been considered a cartel with the main player, the company De Beers, being involved in diamond production and trade since 1880 (Spar, 2006; Haufler, 2009). In the early 1990s, De Beers was responsible for nearly 50% of the world's rough diamond production and sold about 80% of the world's total supply through its Central Trading Organization, known today as Diamond Trading Company (The Economist, 2007). As Spar (2006) documents in greater detail, De Beers has been highly successful in controlling production and the available stock of rough diamonds on the market. At the same time, De Beers invested in creating sustained demand and a high willingness to pay among consumers by creating the illusion that diamonds are scarce and a symbol of enduring love. Its slogan "A diamond is forever" became famous. In the 1990s, with the end of the Soviet Union and the end of the apartheid regime in South Africa, the opening of new mines, and antitrust litigation in the US, among others, De Beers' faced difficulties in maintaining its system of managing production and demand and, in turn, its market share declined (Spar, 2006; Haufler, 2009). Additionally, growing international awareness about "blood diamonds" threatened the diamond industry, and De Beers in particular. Some, therefore, argue that De Beers highly benefited from the Kimberley Process as it helped regulate the market and reduce the flow of illegal diamonds into the world market (Spar, 2006; Haufler, 2009).

Before KPCS, data on diamond production, especially alluvial diamond production, is often not reliable if available at all. One indication that production figures are not reliable is the (sometimes vast) discrepancy between export and import values for producing and trading countries (US GAO, 2002). Based on estimated export values for rough diamonds for the year 2000, major producing countries in Africa were (in descending order) Botswana, South Africa, the Democratic Republic of the Congo, Namibia, Angola, the Central African Republic, Guinea, and Liberia (US GAO, 2002, p. 53).

As KP members are required to submit statistics on their diamond production as well as exports and imports, for most important diamond producers relevant figures are available from the official KP website (link) as of the year 2004. In Appendix Figure A1 we report figures on the average annual diamond production by volume (carats) and value (US Dollars) for KP members for the period 2004 to 2013. Members with no production are not included in the table. For members who joined after 2004, we report production averages for years with available information. Albeit Russia, Australia, and Canada produced significant amounts of diamonds in the 2000s, African countries contributed more than half of all diamonds in the market in terms of both total volume and total value.

Table A1: KP Members' Average Diamond Production (2004-2013)

Country	Carats		Value	
	in Thousands	% of Total	in Millions of $	% of Total
Russian Federation	36,801.15	24.99%	2,583.08	21.78%
Botswana	26,953,26	18.31%	2,941.67	24.81%
Democratic Republic of the Congo	25,186.01	17.10%	328.18	2.77%
Australia	17,088.50	11.61%	354.74	2.99%
Canada	12,467.79	8.47%	1,866.54	15.74%
South Africa	10,996.61	7.47%	1,209.10	10.20%
Angola	8,387.08	5.70%	1,070.87	9.03%
Zimbabwe	4,320.43	2.93%	217.10	1.83%
Namibia	1,843.53	1.25%	778.64	6.57%
Guinea	765.73	0.52%	39.43	0.33%
Ghana	585.82	0.40%	18.35	0.15%
Sierra Leone	528.46	0.36%	129.06	1.09%
Central African Republic	337.99	0.23%	51.28	0.43%
Lesotho	199.74	0.14%	179.40	1.51%
Guyana	192.65	0.13%	24.09	0.20%
Tanzania	191.23	0.13%	26.72	0.23%
Brazil	114.39	0.08%	8.99	0.08%
Congo, Republic of	109.41	0.07%	2.90	0.02%
China, People's Republic of	41.70	0.03%	0.68	0.01%
Liberia	36.93	0.03%	13.10	0.11%
India	31.54	0.02%	4.91	0.04%
Indonesia	25.63	0.02%	5.80	0.05%
Togo	19.59	0.01%	1.91	0.02%
Venezuela	18.00	0.01%	1.22	0.01%
Cameroon	1.76	0.00%	0.42	0.00%
Total	147,244.94	100.0%	11,858.17	100.0%

Notes: This table reports the average annual diamond production by volume (carats) and value (US Dollars) for KP members for the period 2004 to 2013 based on statistics published on the official KP website (link). Members with no production are not included in the table. For members who joined after 2004, we report production averages for years with available information.

B African Countries: KP Membership and Diamond Deposits

Table A2: KP Membership and Diamond Deposits (African Countries)

Country	KP Member? (Year joining)	Primary Diamond Deposits	Secondary Diamond Deposits
Algeria	No	No	Yes
Angola	Yes (2003)	Yes	Yes
Benin	No	No	No
Botswana	Yes (2003)	Yes	Yes
Burkina Faso	Applicant	Yes	No
Burundi	No	No	No
Cameroon	Yes (2012)	No	No
Cape Verde	No	No	No
Central African Republic	Yes (2003)	No	Yes
Chad	No	No	Yes
Comoros	No	No	No
Democratic Republic of the Congo	Yes (2003)	Yes	Yes
Djibouti	No	No	No
Egypt	No	No	No
Equatorial Guinea	No	No	No
Eritrea	No	No	No
Eswatini	Yes(2011)	Yes	No
Ethiopia	No	No	No
Gabon	2018	Yes	Yes
Gambia	No	No	No
Ghana	Yes (2003)	No	Yes
Guinea	Yes (2003)	Yes	Yes
Guinea-Bissau	No	No	No
Ivory Coast	2003	Yes	Yes
Kenya	Applicant	No	No
Lesotho	Yes (2003)	Yes	Yes
Liberia	Yes (2007)	Yes	Yes
Libya	No	No	No
Madagascar	No	No	No
Malawi	No	No	No
Mali	Yes (2013)	Yes	Yes
Mauritania	Applicant	Yes	No
Mauritius	Yes (2013)	No	No
Morocco	No	No	No
Mozambique	Yes (2021)	Yes	Yes
Namibia	Yes (2003)	Yes	Yes
Niger	No	No	No
Nigeria	No	No	Yes

Continued on next page...

Table A3: KP Membership and Diamond Deposits (African Countries) (Cont'd)

Country	KP Member? (Year joining)	Primary Diamond Deposits	Secondary Diamond Deposits
Continued from previous page...			
Republic of the Congo	Yes (2003/2007)	No	Yes
Rwanda	No	No	No
Sahrawi Arab Democratic Republic	No	No	No
São Tomé and Príncipe	No	No	No
Senegal	No	No	No
Seychelles	No	No	No
Sierra Leone	Yes (2003)	Yes	Yes
Somalia	No	No	No
South Africa	Yes (2003)	Yes	Yes
South Sudan	No	No	No
Sudan	No	No	No
Tanzania	Yes (2003)	Yes	Yes
Togo	Yes (2003)	No	No
Tunisia	No	No	No
Uganda	No	No	No
Zambia	Applicant	No	Yes
Zimbabwe	Yes (2003)	Yes	Yes

Notes: In 2003, 14 African states were members of the Kimberley Process (KP). Other early members were, among others, Australia, Brazil, Canada, China, the European Union (counted as a single participant), India, Israel, Japan, Norway, Russia, Switzerland, and the United States. The Republic of the Congo was expelled in 2004 and readmitted in 2007. *Sources:* Column 2: KP website (link), columns 3 and 4: Gilmore et al. (2005).

C Summary Statistics

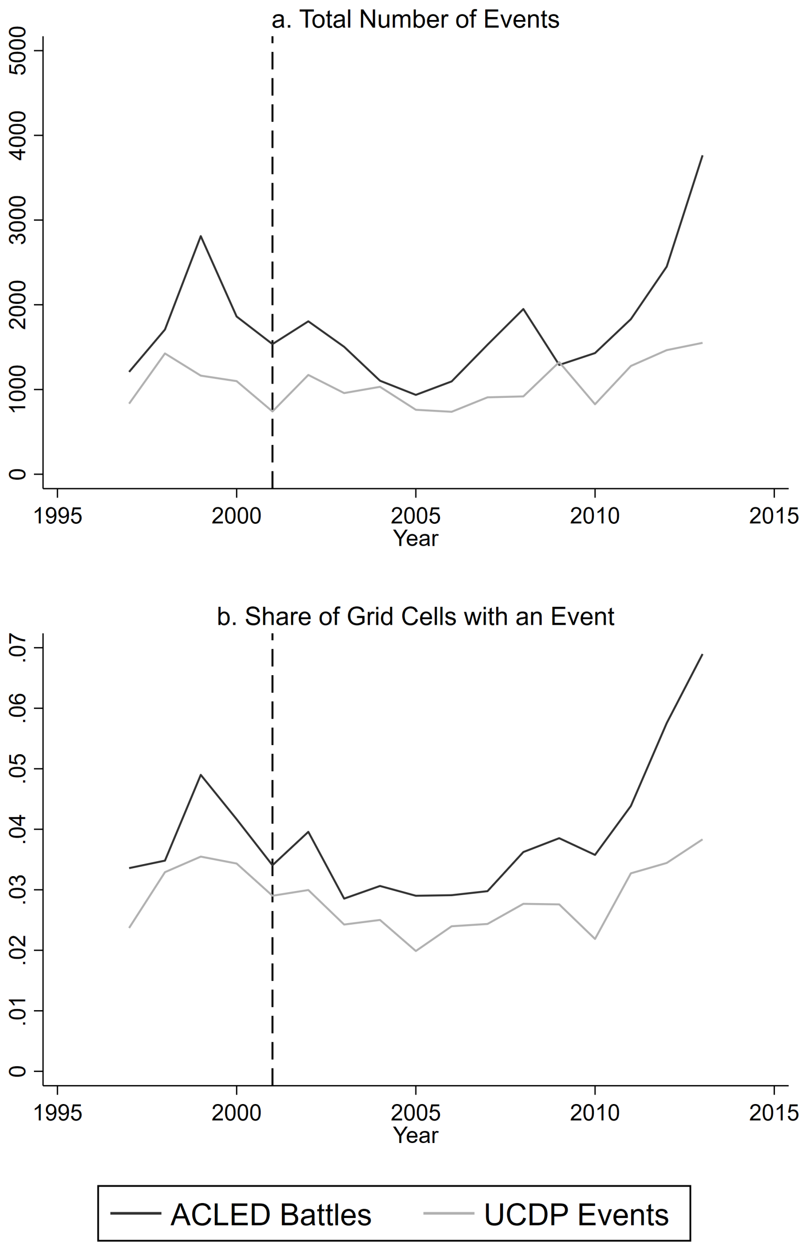

Figure A1: Armed Conflict Events Over Time: ACLED and UCDP

Notes: This figure shows in Panel a. the total number of conflict events by year and in Panel b. the share of grid cells with at least one conflict event by year. This is shown for battles reported by the Armed Conflict Location & Event Data Project (dark grey line) and for armed conflicts reported by the UCDP/PRIO Armed Conflict Dataset (light grey line).

Table A4: Descriptive Statistics (Grid-Cell Level) based on ACLED

	Observations	Mean	Std. Dev.	Min	Max
Incidence of armed conflict ('battle'):					
Pre-KPCS (1997-2000)					
All cells	40,512	0.039	0.194	0	1
Secondary diamond propensity=1	2,756	0.086	0.281	0	1
Secondary diamond propensity=0	37,756	0.036	0.186	0	1
Post KPCS 1 (2002-2005)					
All cells	40,512	0.032	0.175	0	1
Secondary diamond propensity=1	2,756	0.038	0.191	0	1
Secondary diamond propensity=0	37,756	0.031	0.174	0	1
Post KPCS 2 (2006-2009)					
All cells	40,512	0.032	0.178	0	1
Secondary diamond propensity=1	2,756	0.029	0.169	0	1
Secondary diamond propensity=0	37,756	0.033	0.178	0	1
Post KPCS 3 (2010-2013)					
All cells	40,512	0.050	0.218	0	1
Secondary diamond propensity=1	2,756	0.041	0.197	0	1
Secondary diamond propensity=0	37,756	0.051	0.219	0	1

Notes: Details on the variables are provided in Section 3.

Table A5: Descriptive Statistics (Grid-Cell Level) based on UCDP/PRIO

	Observations	Mean	Std. Dev.	Min	Max
Incidence of armed conflict:					
Pre-KPCS (1997-2000)					
All cells	40,512	0.033	0.178	0	1
Secondary diamond propensity=1	2,756	0.067	0.250	0	1
Secondary diamond propensity=0	37,756	0.030	0.171	0	1
Post KPCS 1 (2002-2005)					
All cells	40,512	0.026	0.158	0	1
Secondary diamond propensity=1	2,756	0.028	0.165	0	1
Secondary diamond propensity=0	37,756	0.026	0.158	0	1
Post KPCS 2 (2006-2009)					
All cells	40,512	0.027	0.162	0	1
Secondary diamond propensity=1	2,756	0.017	0.131	0	1
Secondary diamond propensity=0	37,756	0.028	0.164	0	1
Post KPCS 3 (2010-2013)					
All cells	40,512	0.033	0.179	0	1
Secondary diamond propensity=1	2,756	0.018	0.132	0	1
Secondary diamond propensity=0	37,756	0.034	0.182	0	1

Notes: Details on the variables are provided in Section 3.

D Additional Results: Yearly Estimates

Table A6: The Effect of the Kimberley Process on Armed Conflicts: Yearly Estimates

	Incidence of Armed Conflict					
			ACLED			UCDP
	(1)	(2)	(3)	(4)	(5)	(6)
Diamonds X 1997	-0.013	-0.024*	-0.004	-0.017	-0.018	-0.025
	(0.021)	(0.013)	(0.017)	(0.019)	(0.016)	(0.019)
Diamonds X 1998	-0.013	-0.024*	-0.006	-0.017	-0.017	-0.012
	(0.024)	(0.014)	(0.018)	(0.022)	(0.019)	(0.023)
Diamonds X 1999	0.001	-0.008	0.004	-0.011	-0.011	-0.017
	(0.022)	(0.016)	(0.021)	(0.020)	(0.017)	(0.024)
Diamonds X 2000	-0.021	-0.014	-0.019	-0.023	-0.024	-0.012
	(0.021)	(0.016)	(0.017)	(0.019)	(0.015)	(0.023)
Diamonds X 2002	-0.042**	-0.016	-0.035**	-0.035*	-0.032**	-0.032*
	(0.019)	(0.019)	(0.016)	(0.019)	(0.014)	(0.019)
Diamonds X 2003	-0.050***	-0.022	-0.036**	-0.045***	-0.041***	-0.046**
	(0.019)	(0.017)	(0.014)	(0.017)	(0.013)	(0.019)
Diamonds X 2004	-0.062***	-0.034**	-0.052***	-0.054***	-0.050***	-0.064***
	(0.018)	(0.014)	(0.014)	(0.016)	(0.013)	(0.018)
Diamonds X 2005	-0.068***	-0.041***	-0.054***	-0.061***	-0.057***	-0.061***
	(0.019)	(0.015)	(0.015)	(0.017)	(0.015)	(0.018)
Diamonds X 2006	-0.054***	-0.027*	-0.041***	-0.046***	-0.027**	-0.063***
	(0.018)	(0.014)	(0.014)	(0.016)	(0.013)	(0.018)
Diamonds X 2007	-0.062***	-0.038***	-0.052***	-0.051***	-0.034***	-0.059***
	(0.017)	(0.013)	(0.013)	(0.015)	(0.012)	(0.017)
Diamonds X 2008	-0.064***	-0.039***	-0.053***	-0.054***	-0.035***	-0.053***
	(0.018)	(0.014)	(0.014)	(0.016)	(0.013)	(0.020)
Diamonds X 2009	-0.082***	-0.057***	-0.070***	-0.072***	-0.054***	-0.079***
	(0.018)	(0.014)	(0.014)	(0.016)	(0.014)	(0.019)
Diamonds X 2010	-0.080***	-0.054***	-0.068***	-0.072***	-0.042***	-0.068***
	(0.017)	(0.014)	(0.013)	(0.016)	(0.013)	(0.018)
Diamonds X 2011	-0.055***	-0.029	-0.045**	-0.040**	-0.011	-0.074***
	(0.020)	(0.017)	(0.018)	(0.019)	(0.015)	(0.018)
Diamonds X 2012	-0.069***	-0.043***	-0.058***	-0.056***	-0.026*	-0.068***
	(0.018)	(0.014)	(0.014)	(0.016)	(0.013)	(0.019)
Diamonds X 2013	-0.085***	-0.056***	-0.071***	-0.068***	-0.038***	-0.068***
	(0.019)	(0.015)	(0.016)	(0.018)	(0.014)	(0.019)
Excl. Angola & Sierra Leone	No	Yes	No	No	No	No
Excl. Cells with Industrial Mining	No	No	Yes	No	No	No
Basic Time-Varying Controls	No	No	No	Yes	Yes	No
Country-Year Fixed Effects	No	No	No	No	Yes	No
Observations	172,176	164,713	169,150	172,176	172,176	172,176
R^2	0.308	0.319	0.308	0.312	0.341	0.313

Notes: Difference-in-differences estimates on the interactions between a dummy for grid cells with secondary diamond propensity and year fixed effects. The results from the aggregated model are reported in Table 1. For further explanations, see Table 1. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

E Additional Results: Conley Standard Errors

Table A7: The Effect of the Kimberley Process on Armed Conflicts: Conley Standard Errors

	Incidence of Armed Conflict					
			ACLED			UCDP
	(1)	(2)	(3)	(4)	(5)	(6)
Diamonds X Pre (1997-2000)	-0.011	-0.018	-0.006	-0.017	-0.018	-0.017
	(0.016)	(0.013)	(0.016)	(0.016)	(0.013)	(0.015)
	[0.020]	[0.016]	[0.016]	[0.019]	[0.012]	[0.023]
	{0.022}	{0.015}	{0.017}	{0.019}	{0.013}	{0.028}
Diamonds X Post1 (2002-2005)	-0.055	-0.028	-0.044	-0.049	-0.045	-0.051
	(0.016)***	(0.015)*	(0.017)***	(0.017)***	(0.013)***	(0.015)***
	[0.020]***	[0.017]	[0.017]***	[0.019]**	[0.012]***	[0.023]**
	{0.022}**	{0.017}*	{0.017}***	{0.020}**	{0.013}***	{0.028}*
Diamonds X Post2 (2006-2009)	-0.065	-0.040	-0.054	-0.056	-0.037	-0.063
	(0.015)***	(0.013)***	(0.015)***	(0.015)***	(0.012)***	(0.015)***
	[0.019]***	[0.016]**	[0.015]***	[0.018]***	[0.011]***	[0.023]***
	{0.021}***	{0.015}***	{0.015}***	{0.019}***	{0.012}***	{0.028}**
Diamonds X Post3 (2010-2013)	-0.072	-0.045	-0.060	-0.059	-0.029	-0.070
	(0.015)***	(0.014)***	(0.016)***	(0.015)***	(0.012)**	(0.015)***
	[0.019]***	[0.016]***	[0.015]***	[0.018]***	[0.011]**	[0.023]***
	{0.021}***	{0.016}***	{0.016}***	{0.019}***	{0.012}**	{0.027}**
Excl. Angola & Sierra Leone	No	Yes	No	No	No	No
Excl. Cells with Industrial Mining	No	No	Yes	No	No	No
Basic Time-Varying Controls	No	No	No	Yes	Yes	No
Country-Year Fixed Effects	No	No	No	No	Yes	No
Observations	172,176	164,713	169,150	172,176	172,176	172,176
R^2	0.307	0.319	0.308	0.312	0.341	0.313

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table replicates the results reported in Table 1 with Conley standard errors. The round (square/brace) parentheses indicate Conley standard errors allowing for a spatial correlation within a radius of 100km (200km/400km). All specifications allow for 4 years of serial correlation. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

F Robustness Analysis: Armed Conflict based on the UCDP/PRIO Armed Conflict Dataset

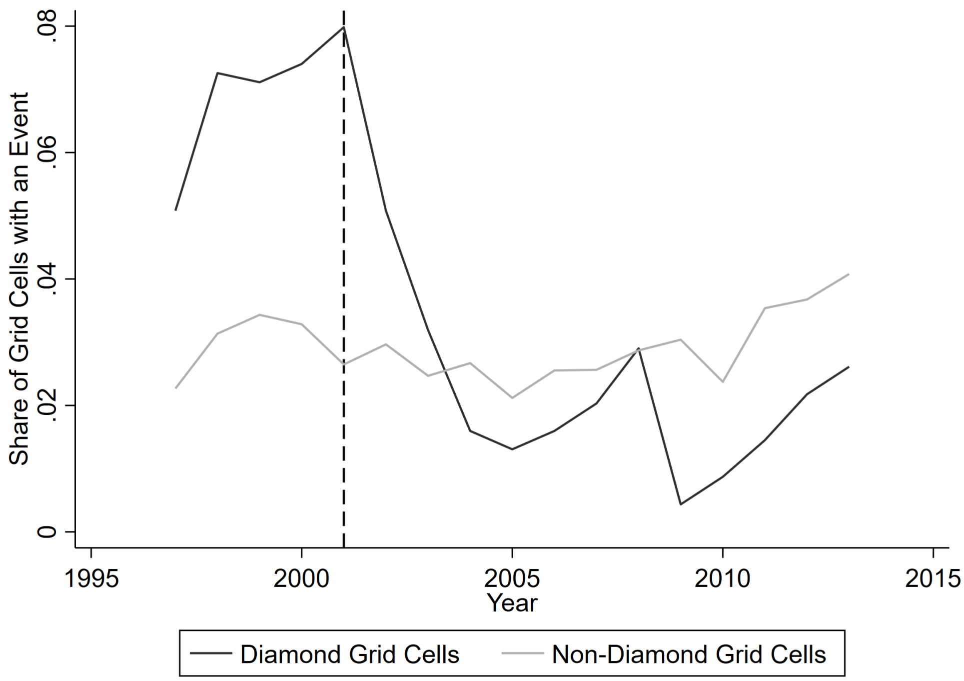

Figure A2: Armed Conflict Events Over Time (UCDP)

Notes: Based on the UCDP/PRIO Armed Conflict Dataset, this figure shows the share of armed conflict events for grid cells with and without secondary diamond propensity.

G Robustness Analysis: Number of Fatalities as the Dependent Variable

Table A8: The Effect of the Kimberley Process on Armed Conflicts: Ln Number of Fatalities

	Log(1 + Total Number of Fatalities)				
			ACLED		
	(1)	(2)	(3)	(4)	(5)
Diamonds X Pre (1997-2000)	0.000	-0.011	-0.004	-0.002	-0.003
	(0.043)	(0.039)	(0.038)	(0.040)	(0.033)
Diamonds X Post1 (2002-2005)	-0.098***	-0.065*	-0.090***	-0.086**	-0.091***
	(0.036)	(0.034)	(0.032)	(0.034)	(0.029)
Diamonds X Post2 (2006-2009)	-0.099***	-0.064*	-0.097***	-0.084**	-0.061**
	(0.036)	(0.034)	(0.031)	(0.034)	(0.027)
Diamonds X Post3 (2010-2013)	-0.116***	-0.079**	-0.108***	-0.091***	-0.047*
	(0.037)	(0.035)	(0.033)	(0.034)	(0.028)
Excl. Angola & Sierra Leone	No	Yes	No	No	No
Excl. Cells with Industrial Mining	No	No	Yes	No	No
Basic Time-Varying Controls	No	No	No	Yes	Yes
Country-Year Fixed Effects	No	No	No	No	Yes
Observations	172,176	164,713	169,150	172,176	172,176
R^2	0.286	0.295	0.286	0.289	0.309

Notes: This table replicates the results based on the ACLED dataset and reported in columns (1) to (5) of Table 1 using as the dependent variable the natural log of one plus the total number of fatalities in grid cell i and year t. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A9: The Effect of the Kimberley Process on Armed Conflicts: IHS Transformation

	Total Number of Fatalities (IHS)				
			ACLED		
	(1)	(2)	(3)	(4)	(5)
Diamonds X Pre (1997-2000)	0.001	-0.013	-0.004	-0.002	-0.004
	(0.050)	(0.045)	(0.044)	(0.047)	(0.038)
Diamonds X Post1 (2002-2005)	-0.114***	-0.076*	-0.103***	-0.100**	-0.106***
	(0.042)	(0.040)	(0.037)	(0.040)	(0.034)
Diamonds X Post2 (2006-2009)	-0.115***	-0.075*	-0.112***	-0.097**	-0.071**
	(0.042)	(0.040)	(0.036)	(0.040)	(0.031)
Diamonds X Post3 (2010-2013)	-0.136***	-0.094**	-0.125***	-0.107***	-0.053
	(0.043)	(0.042)	(0.038)	(0.040)	(0.033)
Excl. Angola & Sierra Leone	No	Yes	No	No	No
Excl. Cells with Industrial Mining	No	No	Yes	No	No
Basic Time-Varying Controls	No	No	No	Yes	Yes
Country-Year Fixed Effects	No	No	No	No	Yes
Observations	172,176	164,713	169,150	172,176	172,176
R^2	0.287	0.296	0.288	0.291	0.310

Notes: This table replicates the results based on the ACLED dataset and reported in columns (1) to (5) of Table 1 using as the dependent variable the inverse hyperbolic sine (IHS) transformation of the total number of fatalities in grid cell i and year t. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

H Robustness Analysis: Alluvial Gold Mining

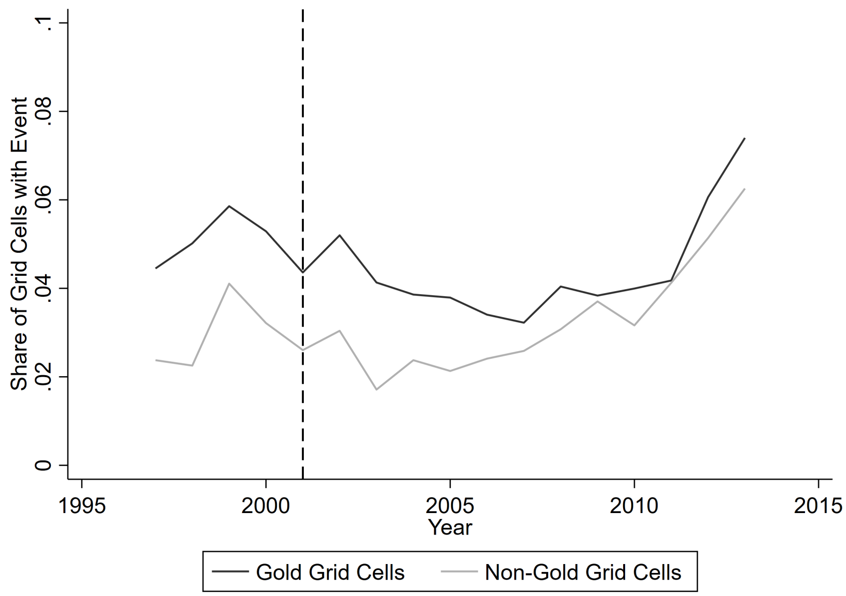

Figure A3: Armed Conflicts in Grid Cells with and without Gold Suitability

Notes: This figure shows, by year, the share of grid cells with and without alluvial gold suitability for which the Armed Conflict Location & Event Data Project (ACLED) reported at least one battle event.

Table A10: The Effect of the Kimberley Process on Armed Conflicts: Alluvial Gold Mining

	Incidence of Armed Conflict					
			ACLED			UCDP
	(1)	(2)	(3)	(4)	(5)	(6)
Gold X Pre (1997-2000)	0.005	0.002	0.006	0.005	0.008	0.000
	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)
Gold X Post1 (2002-2005)	0.006	0.008	0.005	0.011*	0.004	-0.001
	(0.006)	(0.005)	(0.006)	(0.006)	(0.004)	(0.006)
Gold X Post2 (2006-2009)	-0.006	-0.005	-0.007	0.001	-0.000	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Gold X Post3 (2010-2013)	-0.005	-0.004	-0.006	0.005	0.003	-0.008
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)
Diamonds X Pre (1997-2000)	-0.013	-0.018	-0.007	-0.018	-0.019	-0.017
	(0.020)	(0.013)	(0.015)	(0.018)	(0.014)	(0.020)
Diamonds X Post1 (2002-2005)	-0.057***	-0.031**	-0.046***	-0.050***	-0.046***	-0.051***
	(0.017)	(0.013)	(0.013)	(0.016)	(0.012)	(0.017)
Diamonds X Post2 (2006-2009)	-0.063***	-0.039***	-0.052***	-0.056***	-0.037***	-0.062***
	(0.017)	(0.013)	(0.012)	(0.015)	(0.012)	(0.017)
Diamonds X Post3 (2010-2013)	-0.071***	-0.044***	-0.059***	-0.060***	-0.030**	-0.068**
	(0.017)	(0.013)	(0.013)	(0.016)	(0.012)	(0.018)
Excl. Angola & Sierra Leone	No	Yes	No	No	No	No
Excl. Cells with Industrial Mining	No	No	Yes	No	No	No
Basic Time-Varying Controls	No	No	No	Yes	Yes	No
Country-Year Fixed Effects	No	No	No	No	Yes	No
Observations	172,176	169,150	164,713	172,176	172,176	172,176
R^2	0.308	0.308	0.319	0.312	0.341	0.313

Notes: This table replicates the results reported in Table 1, adding to the baseline specification interaction terms between the period dummies and a dummy for grid cells with alluvial gold suitability. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.