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The Dodd-Frank Act's Persistent Effect on Violence in the Democratic Republic of Congo

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Abstract
The 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act sought to enhance peace and security in the Democratic Republic of Congo (DRC) by introducing, beginning in 2014, disclosure and reporting requirements for firms utilizing conflict minerals. Despite its policy ambitions, the Act's long-run impacts remain insufficiently understood, as prior studies either concentrate on the pre-2016 period or lack an appropriate pre-treatment comparison. This study estimates the effects of the Dodd-Frank Act through 2022, while addressing potential endogeneity associated with mining operations and survey team visits, as well as confounding influences from improvements in data collection. The analysis reveals that the Act did not reduce violence in the DRC; rather, it contributed to the geographic diffusion of conflict across territories with gold mines. In contrast, no measurable effects are observed on the incidence or intensity of violence in territories containing "3T" mines—the other minerals targeted by the Act. These heterogeneous effects likely reflect strategic shifts among armed groups, who increasingly contested control over gold mines owing to gold's portability and limited traceability.

Keywords
Conflict, Minerals, Natural Resources, International Trade Policy, Dodd-Frank Act, Unintended Consequences, Democratic Republic of the Congo, and Central Africa

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I. Introduction

In 2010, the U.S. Congress sought to promote peace and security in the Democratic Republic of Congo (DRC) by curtailing the revenue of non-state armed groups derived from the mining and trade of conflict minerals.[2] Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) required the Securities and Exchange Commission (SEC) to promulgate regulations requiring corporate disclosure and reporting on the use of such minerals. The legislation was contentious from the outset, as critics argued that it misconstrued the underlying drivers of conflict and warned that the heightened poverty resulting from the de-facto boycott of targeted minerals could exacerbate violence (Seay 2012).

Quantitative studies of the early, pre-2016 period (Bloem 2023; Parker and Vadheim 2017; Stoop et al. 2019) consistently document a rise in violence following the implementation of the Dodd-Frank Act. A more recent and comprehensive, though potentially more constrained, analysis by Baik et al. (2024) offers a more nuanced perspective over the longer term: violence intensified in territories containing gold mines but declined in those with "3T" mines (tantalum, tin, and tungsten). Given the recent resurgence of conflict and the estimated seven million internally displaced persons, understanding the enduring effects of the Dodd-Frank Act and the associated Securities and Exchange Commission (SEC) rule remains critically important for the DRC. More broadly, the DRC continues to serve as a focal case for evaluating policy interventions in resource-extractive sectors aimed at mitigating violence.

To identify the causal effects of the Dodd-Frank Act and the associated SEC rule, we employ a fixed-effects regression framework combining geo-referenced data on artisanal mining operations with spatially disaggregated information on violent events. This approach allows to separate the aggregate effects of the Dodd-Frank Act from the mineral-specific effects while controlling for both time and location fixed effects. The results indicate that the Dodd-Frank Act did not mitigate violence in the DRC. Instead, it contributed to the diffusion of conflict across territories with gold mines and, in many specifications, to elevated levels of violence in these areas. By contrast, we find no statistically significant effects on either the incidence or intensity of violence in territories with 3T mines. These divergent patterns likely reflect

[2]The Dodd-Frank Act defines conflict minerals as columbite-tantalite (coltan), cassiterite, wolframite, gold, or their derivatives, or any other mineral or its derivatives that the Secretary of State determines to be financing conflict in the DRC or an adjoining country. Tantalum, tin, and tungsten—the derivatives of columbite-tantalite (coltan), cassiterite, wolframite, respectively—and gold are used in industrial and other applications. We use "conflict minerals" to refer to either these ores or these metals.

the strategic adaptation of armed groups, who have increasingly contested control over gold mines due to gold's higher portability and lower traceability relative to the other targeted minerals.

Our empirical strategy addresses three potential sources of bias that affect prior research to varying degrees. First, we account for the potential endogeneity of mining activity and survey team visits to areas affected by violence or the presence of armed groups. Previous studies have relied on artisanal mining data from the International Peace Information Service (IPIS), yet increased violence may have prevented the organization from accessing certain regions, or conversely, violent dynamics may have influenced the establishment of new mining sites.[3]

Second, we examine whether the observed relationship between violence and the Dodd-Frank Act might be driven by improvements in conflict data collection practices, particularly in the years following the Act's implementation. The literature employs data from the Armed Conflict Location and Event Data (ACLED) project, which became increasingly dependent in the DRC on reports from a single local organization, the Kivu Security Tracker (KST). Established in 2017, the KST rapidly grew into a principal source of data for ACLED. The proportion of reported violent events in eastern DRC recorded exclusively by KST rose from 6 percent in 2017 to 38 percent in 2018. Although earlier studies did not extend beyond 2016, Baik et al. (2024) analyze data through 2019—a period during which KST's growing contribution to ACLED likely inflated recorded levels of violence.

Finally, our identification strategy differs from that of Baik et al. (2024), the only study to examine the longer-term effects using data extending beyond 2016. In contrast to their approach, which treats 2014—the year in which the SEC began enforcing disclosure requirements—as the intervention point, we follow the earlier literature in designating July 2010, the enactment date of the Dodd-Frank Act, as the onset of treatment. Although the SEC finalized the implementing rule in 2012 and required disclosures beginning in 2014, actor immediately changed their behavior after the Act's passage. For example, both the DRC government and several industry groups instituted mineral export bans in 2010 and 2011, respectively.[4] Moreover, our interviews with industry stakeholders indicate that firms began preparing for compliance even before the SEC's rulemaking was completed. Consequently, using 2010 as the intervention date

[3]The risk of violence has been found to impact rural livelihoods in other contexts (Arias et al., 2019; Rockmore 2020, Verpoorten, 2009).

[4]President Joseph Kabila announced a ban on artisanal mineral exploitation in eastern DRC that lasted from September 2010 until March 2011. Similarly, two global coalitions of major electronic companies announced in 2011 that they had stopped buying affected minerals from smelters that could not prove their source minerals were not connected to conflict in the DRC.

more accurately captures the period when the Act began to affect behaviors and expectations. Baik et al. (2024), by using a 2014 intervention date with data spanning 2010–2019, effectively compare only post-treatment periods, limiting causal interpretation.

The remainder of the paper is structured as follows. The context, methodology, and data are presented in Sections II, III, and IV. Sections V, VI, and VII examine the parallel trends assumption, and the effect of the Dodd-Frank Act on the occurrence and levels of violence and battles, while Section VIII concludes.

II. Background

The Democratic Republic of Congo (DRC) has endured recurrent political instability and armed conflict since gaining independence from Belgium in 1960. Between 1998 and 2003, the DRC and eight other African states engaged in the Second Congo War, which resulted in the deaths of at least three million people within the DRC. In response, the United Nations established a peacekeeping mission in 1999—now known as the United Nations Organization Stabilization Mission in the DRC (MONUSCO). Despite this intervention, numerous armed groups continue to operate in eastern DRC, particularly in areas rich in conflict minerals.[5]

In 2010, Congress enacted the Dodd-Frank Act, which noted that the trade in conflict minerals contributed to financing armed conflict in the DRC. Section 1502 of the act required the Securities and Exchange Commission (SEC) to promulgate regulations requiring companies to disclose and report their use of such minerals. The SEC finalized this rule in 2012, with mandatory annual disclosure filings beginning in 2014.[6] According to the SEC, Congress intended the rule to promote peace and security in the DRC by diminishing non-state armed groups' revenues from the extraction and trade of conflict minerals.

During the period we study, the number of battles and incidents of violence against civilians in eastern DRC, remained relatively constant from 2004—after the Second Congo War—through 2016, steadily

[5]A DRC government official we interviewed estimated the total number of 3T and gold mines in the DRC at 4,000 to 5,000. The International Peace Information Service, a Belgian research institute, has mapped approximately 2,800 of these mines in eastern DRC.

[6]In August 2012, SEC adopted its disclosure rule for conflict minerals in response to Section 1502(b) of the Dodd-Frank Act. The rule requires certain companies to (a) file a specialized disclosure report, Form SD, if they manufacture, or contract to have manufactured, products that contain conflict minerals necessary to those products' functionality or production and (b) file an additional conflict minerals report, if applicable.

increased from 2017 through 2021, and dropped slightly in 2022, according to ACLED data.[7] Most battles occurred between non-state armed groups and Congolese security forces. As battles increased, so too did incidents of violence against civilians, including attacks, sexual violence, abductions, and forced disappearances. While armed groups perpetrated the majority of these abuses, Congolese security forces, including the army and police, were also implicated according to ACLED data. Experts noted that, regardless of stated motivations, armed groups frequently prey on local populations and commit widespread abuses such as raping civilians and destroying villages.[8]

According to the Kivu Security Tracker (KST), roughly 120 armed groups operated in eastern DRC in 2020, the most recent year for which comprehensive data are available.[9] The size and strength of these groups fluctuate as factions splinter, dissolve, or form alliances, consistent with findings from the UN Group of Experts on the DRC and interviews conducted with regional specialists. These structural shifts often arise from internal divisions or external pressures, such as offensives by the Armed Forces of the DRC (known by the French acronym FARDC) or conflicts with rival groups.

The violence in eastern DRC has affected the sense of security among civilians, who are often targeted by armed groups and Congolese security forces, according to experts. For example, M23 has perpetrated deadly attacks and gang rapes among civilian populations associated with, or perceived to support, the Democratic Forces for the Liberation of Rwanda (FDLR) and other armed groups, according to the UN Group of Experts. Civilian insecurity has led to an overall increase in the numbers of internally displaced persons and refugees from the region. The violence has driven one of the largest internal displacement crises globally, with an estimated 6.9 million people displaced within the DRC by the end of 2023 (IOM 2024). The same source reported that M23's territorial expansion alone displaced more than one million civilians in North Kivu Province as of mid-April 2023.

III. Methodology

[7]The increase in violence that began in 2017 was attributable in part to shifting alliances among various armed groups, the emergence of the armed group Cooperative for the Development of the Congo (CODECO), and the strengthening of a separate group, Allied Democratic Forces (ADF), according to experts we interviewed. In particular, ADF and CODECO factions tend to attack civilians, whereas other armed groups focus more on theft and taxation, according to experts from a research institution.

[8]We conducted extensive interviews with government officials, NGOs, and research institutions in the DRC, Europe and the US. The methodology section contains further information.

[9]Groups may range in size from very small militias, with 30 or 40 combatants, to groups of more than 1,000, according to the UN Group of Experts. The structure of these armed groups also varies; some groups are well organized, while others are loosely defined self-defense militias.

Because the policy applies nationally and levels of violence in the DRC far exceed those neighboring countries, there are no conventional unaffected control units against which to compare treated territories. Consequently, to identify causal effects, we follow the established literature and base our strategy on the substance of the SEC rule, which prescribes procedures that firms must follow when applicable.[10] Specifically, companies that manufacture, or contract to manufacture, products containing 3T minerals or gold originating from the DRC are required to assess whether (1) the minerals benefited armed groups and (2) adhere to a nationally or internationally recognized due diligence framework. These frameworks ask whether the minerals are originate from conflict-affected or high-risk areas.[11] Thus, the policy primarily targets mining regions with a known presence of armed groups, while mines in "conflict-free" territories remain largely unaffected.

We complemented the quantitative analysis with extensive qualitative research. Fieldwork was conducted in Kinshasa, where we interviewed officials from the Government of the DRC, representatives from local research institutions and staff from local and international NGOs to capture a broad cross-section of perspectives. In parallel, we conducted interviews with relevant U.S. government officials, including those from the Department of State and USAID, as well as conflict minerals experts based in the U.S and Europe.

Our empirical approach compares territories in eastern DRC that were likely to be more directly exposed to the policy with those likely to be less affected. The treated territories correspond to mining areas under armed group influence—regions most directly impacted by the SEC rule. Specifically, these include (1) territories where the DRC government imposed a ban on artisanal mining between September 2010 and March 2011 in an effort to stem violence (Geenan et al. 2011), and (2) territories containing at least one mine geolocated within the U.S. Department of State's 2011 map of conflict mineral zones in eastern DRC.[12]

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[10]To comply with the rule, the process broadly requires a company to take the following steps: (1) Determine whether the company manufactures, or contracts to have manufactured, products with "necessary" conflict minerals. (2) Conduct a reasonable country-of-origin inquiry (RCOI) to determine the origin of those conflict minerals. (3) Exercise due diligence, if appropriate, to determine the source and chain of custody of those conflict minerals and whether they benefited armed groups, and adhere to a nationally or internationally recognized due diligence framework, as available for these necessary conflict minerals.

[11]The Organisation for Economic Co-operation and Development (OECD) states that conflict-affected and high-risk areas are identified by the presence of armed conflict, widespread violence, or other risks of harm to people.

[12]In 2011, the U.S. Department of State produced a map of mines and areas under the control of armed groups in the DRC as required by Section 1502 of the Dodd-Frank Act.

This comparison likely understates the policy's overall impact on violence. As Parker and Vadheim (2017) note, "the drawback of this model is that heavily endowed territories outside the policy-targeted zone are not clean counterfactuals for heavily endowed territories inside the zone, if the Dodd-Frank Act caused battles for their control." They further conclude that, if the policy induced spatial spillovers of violence into non-policy territories, "these comparisons are biased downward and understate the true effect of the policies." Additionally, migration of miners seeking new income opportunities could similarly bias our estimates downward by dispersing violence across territories.

Our model builds on Parker and Vadheim (2017), whose fixed-effect model is widely used to estimate the effect of the Dodd-Frank Act on violence in eastern DRC. We implement both a linear probability model for binary outcomes and a negative binomial regression for count outcomes. The linear probability specification serves as our preferred model because it mitigates potential bias arising from changes in reporting practices following the Act's enactment. For example, improved reporting could erroneously suggest an increase in violence over time. By focusing on the presence of violence rather than the number of events, the linear probability model reduces susceptibility to measurement error and provides a more robust estimate of the policy's effect.

Specifically, we estimate variants of the following:

$$
\begin{aligned}
&E(Violence_{itk}) \\
&\quad = \delta_i + \mu_t + \beta_1 policy_{it} + \beta_2(policy_{it} * gold_i) + \beta_3(policy_{it} * 3T_i) \\
&\quad + \sum_{m=1}^{4} \lambda_m(mine_{im} * price_{tm}) + \sum_{k=1}^{3} \gamma_k season_i + \sum_{x=0}^{2} \eta_x rain_{i,t-x} \\
&\quad + \sum_{x=1}^{3} \alpha_x violence_{i,t-x} + \sum_{x=0}^{1} \theta_x adj.violence_{i,t-x}
\end{aligned}
$$

Where *Violence* denotes violence within second-level administrative units *i,* in month *t*, during season *k* (wet, dry, neither). The variable *m* denotes the four minerals of interest—gold, tantalum, tin, and tungsten.

Policy captures the implementation of the Dodd-Frank Act. Following the literature, we code July, 2010 as 0.33—the Act was enacted July 21, 2010—and as 1 for all subsequent months. Although the SEC finalized the implementing rule in 2012 and began requiring disclosures in 2014, firms and other stakeholders began adjusting behaviors immediately following the Act's passage. We therefore define the pre-intervention period as July 2004 through June 2010 and the post-intervention period as August 2010 through December 2022.

The primary treatment coefficient identifies units most likely to have been directly affected by the disclosure rule. Consistent with the empirical literature, we define "treated" territories as the union of second-level administrative units subject to the artisanal mining ban announced by the President of the DRC between September 2010 and March 2011 and those containing at least one mine whose geocoordinates fall within the U.S. Department of State's 2011 map of conflict mineral zones.[13]

The model estimates treatment effects over time and across second-level administrative units most directly exposed to the SEC regulation. It compares these treated units to those expected to be less affected, controlling for other determinants of violence. As a result, the estimated coefficients capture the differential effect between more and less directly affected territories. To the extent that the SEC disclosure rule generated spillover violence in nominally untreated areas, our estimates likely understate the policy's overall impact.

The coefficient on the interaction term for gold mines, β_2, measures the additional effect of the SEC disclosure rule for each additional gold mine within a treated administrative unit. This specification allows the Act's impact on violence to vary with the local intensity of gold production. Similarly, the coefficient on the interaction term for 3T mines, β_3, captures the corresponding marginal effect for tantalum, tin, and tungsten mines, enabling analysis of how the policy's association with violence differs by mineral type.

The term δ_i denotes second-level administrative unit fixed effects, while μ_t represents the month fixed effects. These capture, respectively, time-invariant characteristics within each administrative unit—such as geography, resource endowment, or historical conflict patterns—and time-specific national shocks, including election cycles or macroeconomic conditions influencing all units simultaneously.

The coefficients λ_m measure the relationship between violence and monthly world mineral prices for each of the four minerals (m = tantalum, tin, tungsten, and gold), interacted with the number of corresponding mines in each administrative unit. This specification allows the analysis to account for potential economic incentives linking fluctuations in mineral prices to local conflict dynamics.

The coefficients γ_k capture the influence of seasonal rainfall patterns across wet, dry, and transitional periods, while the η_x coefficients measure the effects of contemporaneous and lagged rainfall deviations

[13]Mining was banned in all of the second-level administrative units in Maniema, North Kivu, and South Kivu Provinces. Bafwasende, Kalemie, Mambasa, Manono, and Nyunzu Provinces had at least one mine with geocoordinates within State's map of conflict mining zones.

on violence. These controls address the possibility that climatic variability may affect both livelihoods and the opportunity costs of participation in armed conflict.

Finally, , α_x and θ_x control for the temporal and spatial persistence of violence. The former includes lags of past monthly violence within each administrative unit, while the latter incorporates the cumulative level of violence occurring in all contiguous units to account for potential spillover effects. Standard errors are clustered at the second-level administrative unit to ensure robustness to serial correlation and spatial dependence.

IV. Data

We focus on eastern DRC because this region accounts for the majority of violent events and conflict minerals production—specifically tantalum, tin, tungsten, and gold.[14] During the period studied, approximately 95 percent of the violent events and battles in the DRC occurred in the eastern provinces. Similar to previous empirical studies, we analyze violence at the second-level administrative unit, which is equivalent to a U.S. county. The first-level administrative units, provinces, are subdivided into the second-level administrative units: cities (*villes*) and territories (*territoires*).

We define eastern DRC as the territories and cities included in State's 2011 "Conflict Minerals Map," which identifies mining areas affected by armed groups. This regions includes Ituri, North Kivu, and South Kivu Provinces and parts of Upper Katanga, Lualaba, Upper Lomami, Maniema, Tanganyika, Tshopo, Lower Uele, and Upper Uele Provinces.[15]

Our analysis covers the period from July 2004 to December 2022 period. We begin in 2004 to avoid exclude violence from the Second Congo War, which ended in 2003 and to ensure the availability of complete data on control variables such as mineral prices. We end in December 2022 because one of the principal local organizations (KST) supplying information to our conflict data source ceased reporting thereafter, rendering post-2022 data incomparable to earlier years.[16]

To examine the effectiveness of the Dodd-Frank Act and the associated SEC rule in "promoting peace and security" in the DRC, we rely on two primary data sources. First, in the absence of systematic metrics

[14]The total number of tantalum, tin, tungsten, and gold mines in the DRC is unknown; it is estimated to be around 4,500 with approximately 3,000 located in eastern DRC.

[15]The data on DRC's subnational administrative units come from the UN Office for the Coordination of Humanitarian Affairs, as posted on the Humanitarian Data Exchange.

[16]Personal correspondence with ACLED.

on peace or security, we follow the literature in using the Armed Conflict Location and Event Data (ACLED) project to measure the incidence of violence.[17] We focus on violent events and battles as defined by ACLED and construct both binary (indicator) and count variables. Violent events include battles, explosions and remote violence, and violence against civilians.

Second, we utilize data from the International Peace Information Service (IPIS) on the location and type of artisanal mines in eastern DRC. We focus on artisanal rather than industrial mines, given their greater exposure to interference by armed groups.[18] Since 2009, IPIS has mapped approximately 2,800 sites, documenting mineral type, GPS coordinates, and dates of data collection. Mines are classified by their primary extracted mineral, though multiple minerals may be mined at a single site.[19]

In our correspondence, IPIS stated that identifying distinct mines over time poses challenges due to frequent changes in nomenclature, mining operations, and geography. A single site may be recorded under multiple names—reflecting a nearby village, landmark, or the largest active pit at a given time—and may also merge or split with other sites. Additionally, mining zones often "move" over time, particularly in alluvial contexts, where the primary extraction site may shift by several kilometers within months. To address this, we identify unique mines by combining their reported names with spatial proximity across time.

Rainfall data are derived from the Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) dataset. These data are used to create binary indicators for wet and dry seasons, defined as months with the highest and lowest average precipitation based on each administrative unit's 1982–2022 precipitation climatology. We also construct variables capturing monthly deviations from long-term precipitation averages.

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[17]ACLED data are based on media reports, reports from nongovernmental and international organizations, selected social media accounts, and information obtained through partnerships with local conflict observatories. While local organizations gather primary data and have coverage that reflects local realities, these initiatives are often limited in scope, according to ACLED. Additionally, ACLED states that media reports may not capture all events. Consequently, ACLED may underreport events such as battles. See Raleigh et al. (2023) for further information on the ACLED data, or https://www.acleddata.com. Accessed on 4/11/2024.f

[18]Artisanal and small-scale mining sites are small, typically labor-intensive mining operations characterized by a lack of mechanization and capital investment.

[19]In personal communication, IPIS stated that the primary mineral gives a good overview of the spatial distribution of gold and 3T minerals. IPIS also stated that the primary general remains stable over time.

The monthly price of each mineral are drawn from the Bloomberg terminal. Tables 1 and 2 present detailed information on data sources, variable construction and summary statistics.

V. Parallel trends assumption

We begin by assessing the validity of our identifying assumption—the parallel trends assumption—which posits that, in the absence of treatment, the difference in violence between treated and non-treated units would have remained stable over time. Figures 1 and 2 display the average monthly number of violent events and battles, respectively, for treated and non-treated second-level administrative units.

As shown, there is no evidence of an upward trend in violence in the period immediately preceding the enactment of the Dodd-Frank Act. Although the patterns of violent events and battles are not perfectly synchronized, both series exhibit broadly similar trajectories before the policy intervention, supporting the plausibility of the parallel trends assumption. Following the Act's enactment, however, a clear divergence emerges: treated units experience a sustained increase in both violent events and battles relative to non-treated units.

This divergence underscores the significance of the treatment's start date. After the Act's enactment in July 2010, levels of violence in treated territories consistently exceed those in non-treated areas. In contrast, there is no visible jump in 2014—the year when firms first began submitting disclosures under the SEC rule—suggesting that local actors did not respond to the formalization of compliance mechanisms.

VI. Analysis of the occurrence of violence

Our preferred model estimates the effect of the Dodd-Frank Act and the SEC disclosure rule on the occurrence of any violent event. As shown in Table 3, column (1), the estimated coefficient for the policy indicator is not statistically significant, suggesting that the Act did not contribute to the overall spread of violence across the DRC. However, in second-level administrative units containing gold mines, the Act is associated with a 69 percent increase in the likelihood of violent events in treated areas with an average number of gold mines.

To assess the robustness of these findings, we conducted a series of sensitivity analyses, each of which yielded broadly comparable results.

Reliance on Kivu Security Tracker data. Because the ACLED database increasingly relied on events data from the Kivu Security Tracker (KST) after 2017—rising from 6 percent of reported violent events

in 2017 to 38 percent in 2018—we investigated whether this shift affected our results.[20, 21] When excluding events reported exclusively by KST, the estimated coefficient for the marginal effect of gold mines remained similar in magnitude and significance to our main specification.

Mines visited prior to 2011. We also examined whether violence may have influenced the timing or location of mine visits conducted by the International Peace Information Service (IPIS). For example, heightened violence may have deterred visits or inhibited the opening of new mining sites.[22] To minimize potential reverse causality, we restricted the mining variable to sites visited before 2011. Under this constraint, the estimated coefficient for the marginal effect of gold mines increased in magnitude, while the policy indicator became statistically significant with a value similar to that of the baseline model.

Mining quartiles. The main specification assumed a linear relationship between violence and the number of mines. To relax this assumption, we divided the interaction between the policy variable and the number of mines into quartiles, with the first quartile representing the 25 percent of second-level administrative units containing the fewest mines. The results show no statistically significant difference in the strength of the policy's effect across quartiles overall. However, we observed higher probabilities of violent events in treated units with both the smallest and largest numbers of 3T mines, as well as in units with the highest concentration of gold mines.

Medium-run effects. We tested whether the results hold over a shorter horizon by limiting the analysis period to July 2004 through December 2016. The marginal effect of gold mines remained statistically significant and continued to indicate elevated likelihoods of violence in treated units.

Linear time trends. To address the possibility that individual territories exhibited pre-existing trends in violence prior to July 2010, we introduced linear time trends for each second-level administrative unit. The estimated coefficient for the marginal effect of gold mines under this specification was nearly identical in magnitude to that in the main model.

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[20]Launched in 2017, the Kivu Security Tracker—a joint project of the Congo Research Group, Bridgeway Foundation, Human Rights Watch, and Ebuteli–maps violence in the eastern DRC to better understand trends, causes of insecurity, and serious violations of international human rights and humanitarian law.

[21]We thank Nik Stoop for the suggestion to examine the effect of the Kivu Security Tracker.

[22]IPIS officials explained that donor funding determined the number of mines that teams visited in a particular year and that most, but not all, mines were already operational before 2008. While teams initially collected data about the start date of mining at each mine, teams stopped asking the question because responses were not always consistent, according to organization officials.

We also used the linear probability model to examine the effect of the Act on the occurrence of any battle. As reported in Table 4, the estimated coefficient for the policy indicator was not statistically significant under any specification. However, with the exception of the model including linear trends, the coefficient representing the marginal effect of gold mines remained statistically significant. This result implies an estimated 102 percent increase in the likelihood of battles within policy-affected areas containing the mean number of gold mines. Similar to our findings for violent events, when we interacted the policy indicator with mining quartiles, we found statistically significant effects of the Act on battles in territories with the fewest 3T mines and those with the highest number of gold mines. The magnitude of these effects varied across quartiles for both sets of variables, indicating heterogeneous responses to the policy intervention.

VII. Analysis of the levels of violence

We used a Poisson regression model to estimate the effect of the Dodd-Frank Act and the SEC disclosure rule on the number of violent events, and we assessed the robustness of these results through several complementary tests. First, we evaluated the sensitivity of the findings to the model's functional form by re-estimating the relationships using ordinary least squares (OLS). Second, similar to our analysis of the spread of violence, we examined the potential influence of the KST's increasing contribution to ACLED data by excluding post-2017 reports, and we further restricted the time frame to pre-2017 data. We also assessed whether violence itself may have influenced mining operations or visits by IPIS.

In the main specification of Table 5 (column 1), the estimated coefficient for the policy indicator indicates that the Dodd-Frank Act did not produce a statistically significant increase in the rate of violent events. Although the direction of the effect is generally consistent across robustness checks, the magnitude of the estimate is not statistically significant in all specifications. In contrast, the interaction term between the policy indicator and the number of gold mines is statistically significant across all specifications with the exception of the OLS model. The corresponding interaction for tantalum, tin, and tungsten (3T) mines is not consistently significant across models.

We find similar results when analyzing the number of battles. As shown in Table 6, the estimated coefficient for the policy indicator is statistically significant in the main specification but becomes insignificant in the robustness checks. The coefficient for the interaction between the policy indicator and the number of gold mines remains statistically significant in all specifications except OLS. In contrast, the interaction term for 3T mines remains statistically insignificant in all models, suggesting that the policy's effects are concentrated in territories associated with gold extraction rather than in those linked to other conflict minerals.

VIII. Conclusion

Ten years after companies first submitted disclosures under the SEC rule, conflict persists and our analysis indicates that the Dodd-Frank Act and the associated SEC rule has not contributed to a measurable improvement in peace and security in the DRC. This result is likely driven by the fact that although conflict minerals play an important role in the conflict's dynamics, they are but one of a number of interdependent factors. Experts on the DRC have noted that even if the SEC rule had successfully cut off armed groups' access to revenues from the minerals trade, conflict would still persist until other entrenched issues—such as a lack of economic opportunities, corruption, lack of capacity in the DRC government, ethnic tensions, and geopolitical rivalries between the DRC and its neighbors—were more comprehensively addressed. Further, even if armed groups' revenues from the conflict minerals trade were reduced, evidence indicates that such groups would find other means of financing themselves, such as extorting residents of the areas they control.

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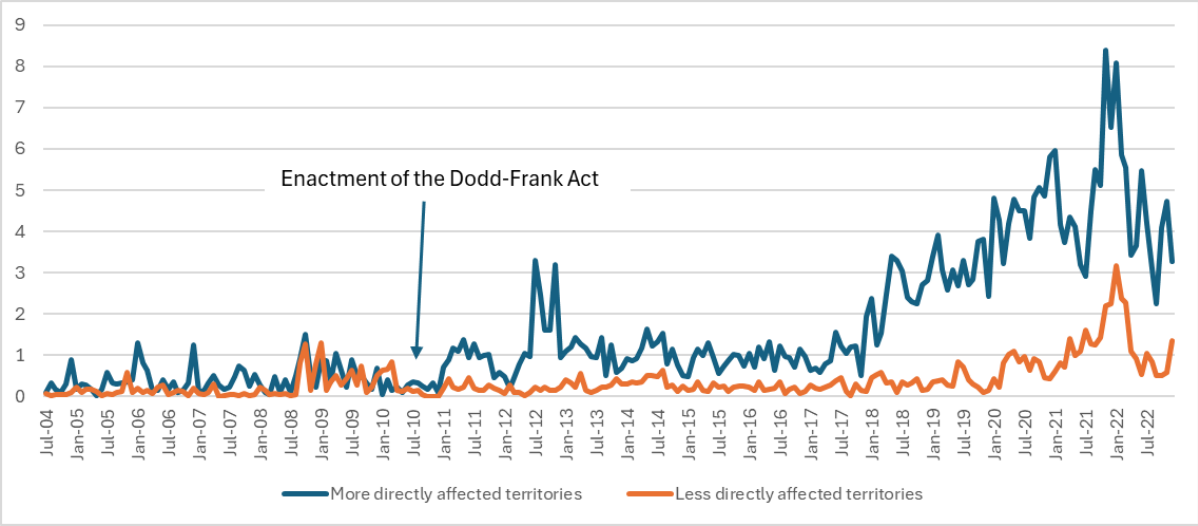
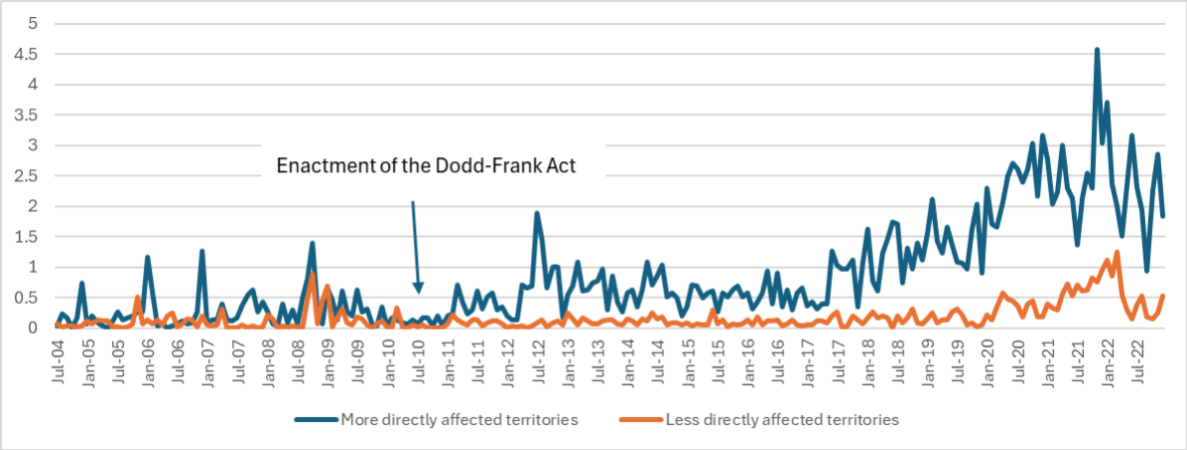
Figure 1: Average Monthly Number of Violent Events in Treated and Nontreated Second-Level Administrative Units of Eastern DRC, July 2004–Dec. 2022



Note: Violent events are measured at the second-level administrative unit (i.e., territory or city). Treated units are the second-level administrative units that were likely to be most affected by the Securities and Exchange Commission's conflict minerals disclosure rule. 77 Fed. Reg. 56,274 (Sept. 12, 2012), codified at 17 C.F.R. § 240.13p-1. Nontreated units are those that were likely to be less affected by the rule.

Figure 2: Figure 15: Average Monthly Number of Battles in Treated and Nontreated Second-Level Administrative Units of Eastern DRC, July 2004–Dec. 2022



Note: Battles are measured at the second-level administrative unit (i.e., territory or city). Treated units are the second-level administrative units that were likely to be most affected by the Securities and Exchange Commission's conflict minerals disclosure rule. 77 Fed. Reg. 56,274 (Sept. 12, 2012), codified at 17 C.F.R. § 240.13p-1. Nontreated units are those that were likely to be less affected by the rule.

Table 1: Variables used the empirical analysis

Outcome (or dependent) variable	**Description**	**Source**
Violent event indicator	We measured violent events by using the "event_type" variable, which we created by combining the “Battles,” “Explosions/Remote violence,” and “Violence against civilians” categories.	ACLED
Battle indicator	We measured battles by using the “event_type” variable.	ACLED
Number of violent events	We measured violent events by using the “event_type” variable, which we created by combining the “Battles”, “Explosions/Remote violence,” and “Violence against civilians” categories.	ACLED
Number of battles	We measured battles by using the "event_type" variable.	ACLED
Independent variable	Description	
Policy indicator	The variable takes non-zero values for policy-treated second-level administrative units, beginning in July 2010. In the month, the variable takes a value of 0.33 because the Dodd-Frank Act—which required the U.S. Securities and Exchange Commission (SEC) to promulgate the conflict minerals disclosure rule—was enacted July 21, 2010.[a] For subsequent months, the variable takes a value of one.	N/A
Interaction between policy indicator and number of gold mines	The variable is the product of the policy indicator and the total number of artisanal gold mines within the second-level administrative unit. We used the count of unique mines in 2004–2022.	IPIS
Interaction between policy indicator and number of 3T mines	The variable is the product of the policy indicator and the total number of artisanal tantalum, tin, or tungsten mines with the second-level administrative unit. We used the count of unique mines in 2004–2022.	IPIS
Interaction between mineral prices and number of mines	The variable is the product of the monthly price of each mineral and the total number of artisanal mines of the same mineral within the same second-level administrative unit. We used the count of unique mines in 2004–2022. For each unit, there are separate variables for tantalum, tin, tungsten, and gold.	Bloomberg Terminal and IPIS
Number of violent events in neighboring locations	The variable is the sum of violent events in contiguous second-level administrative units.	ACLED
Number of battles in neighboring locations	The variable is the sum of battles in contiguous second-level administrative units.	ACLED
Rainfall levels	The variable is the difference between monthly precipitation and the monthly average specific to each second-level administrative unit for 1982–2022.	CHIRPS
Wet season indicator	The variable takes a value of 1 for the 3 months with the greatest average precipitation, based on unit-specific monthly precipitation averages for 1982–2022.	CHIRPS
Dry season indicator	The variable takes a value of 1 for the 3 months with the lowest average precipitation, based on unit-specific monthly precipitation averages for 1982–2022.	CHIRPS
Location indicators	There is a variable for each of the 90 second-level administrative units.	ACLED
Time indicators	There is a variable for each month except the first, which is omitted.	N/A

Legend: ACLED = Armed Conflict Location and Event Data; CHIRPS = Climate Hazards group InfraRed Precipitation with Stations; DRC = Democratic Republic of the Congo; IPIS = International Peace Information Service; N/A = not applicable; SEC = Securities and Exchange Commission.

Table 2: Summary statistics

Variable	**Mean**	**Standard deviation**	**Minimum value**	**Maximum value**
Violent event indicator	0.18	0.38	0	1
Battle indicator	0.11	0.32	0	1
Number of violent events	0.87	3.94	0	96
Number of battles	0.44	2.22	0	79
Policy indicator	0.27	0.44	0	1
Interaction between policy indicator and number of gold mines	13.04	45.13	0.00	279.00
Interaction between policy indicator and number of 3T mines	6.58	20.96	0.00	131.00
Interaction between gold prices and number of gold mines	536.24	669.64	0.00	1975.86
Interaction between tantalum prices and number of tantalum mines	17.45	32.87	0.00	131.00
Interaction between tin prices and number of tin mines	2.63	4.38	0.00	20.49
Interaction between tungsten prices and number of tungsten mines	39.58	100.70	0.00	473.00
Number of violent events in neighboring locations	3.80	9.89	0	149
Number of battles in neighboring locations	1.97	5.46	0	82
Rainfall levels	-0.01	0.36	-1.91	2.89
Wet season indicator	0.25	0.44	0	1
Dry season indicator	0.25	0.43	0	1

Table 3: Occurrence of any violence

Dependent variable: indicator variable for any violence						
	Full sample	**Without Kivu Security Tracker**	**Mines, pre-2011**	**Mining quartiles**	**2016 and earlier**	**Linear Trends**
Policy indicator	0.061*	0.053	0.083**	0.111**	0.010	-0.049
	(0.035)	(0.032)	(0.038)	(0.052)	(0.029)	(0.045)
Policy indicator x number of 3T mines	-0.001	-0.001	-0.002	—	0.000†	0.001
	(0.001)	(0.001)	(0.003)	—	(0.001)	(0.001)
Policy indicator x number of gold mines	0.001***	0.001***	0.006***	—	0.001***	0.001**
	(0.000)	(0.000)	(0.002)	—	(0.000)	(0.000)
Policy indicator x quartile 1 of 3T mines	—	—	—	-0.176***	—	—
	—	—	—	(0.063)	—	—
Policy indicator x quartile 2 of 3T mines	—	—	—	-0.015	—	—
	—	—	—	(0.093)	—	—
Policy indicator x quartile 3 of 3T mines	—	—	—	-0.099	—	—
	—	—	—	(0.067)	—	—
Policy indicator x quartile 4 of 3T mines	—	—	—	-0.140**	—	—
	—	—	—	(0.063)	—	—
Policy indicator x quartile 1 of gold mines	—	—	—	0.054	—	—
	—	—	—	(0.074)	—	—
Policy indicator x quartile 2 of gold mines	—	—	—	0.035	—	—
	—	—	—	(0.070)	—	—
Policy indicator x quartile 3 of gold mines	—	—	—	0.012	—	—
	—	—	—	(0.075)	—	—
Policy indicator x quartile 4 of gold mines	—	—	—	0.308***	—	—
	—	—	—	(0.063)	—	—
Number of observations	19,710	19,710	19,710	19,710	13,230	19,710

Legend: * = statistically significant at the 10 percent level; ** = statistically significant at the 5 percent level; *** = statistically significant at the 1 percent level; † = absolute value less than 0.0004; — = not applicable; 3T = tantalum, tin, and tungsten; DRC = Democratic Republic of the Congo; SEC = Securities and Exchange Commission.

Table 4: Occurrence of any battles

	Dependent variable: indicator variable for any battles					
	Full sample	**Without Kivu Security Tracker**	**Mines, pre-2011**	**Mining quartiles**	**2016 and earlier**	**Linear Trends**
Policy indicator	0.032	0.035	0.052	0.073	0.020	-0.017
	(0.030)	(0.029)	(0.034)	(0.046)	(0.027)	(0.036)
Policy indicator x number of 3T mines	0.000	0.000	0.000	—	0.000	0.001
	(0.001)	(0.001)	(0.003)	—	(0.000)	(0.001)
Policy indicator x number of gold mines	0.001***	0.001***	0.005***	—	0.001***	0.000*
	(0.000)	(0.000)	(0.001)	—	(0.000)	(0.000)
Policy indicator x quartile 1 of 3T mines	—	—	—	-0.155***	—	—
	—	—	—	(0.056)	—	—
Policy indicator x quartile 2 of 3T mines	—	—	—	-0.034	—	—
	—	—	—	(0.077)	—	—
Policy indicator x quartile 3 of 3T mines	—	—	—	-0.032	—	—
	—	—	—	(0.060)	—	—
Policy indicator x quartile 4 of 3T mines	—	—	—	-0.077	—	—
	—	—	—	(0.058)	—	—
Policy indicator x quartile 1 of gold mines	—	—	—	0.073	—	—
	—	—	—	(0.063)	—	—
Policy indicator x quartile 2 of gold mines	—	—	—	0.010	—	—
	—	—	—	(0.054)	—	—
Policy indicator x quartile 3 of gold mines	—	—	—	0.010	—	—
	—	—	—	(0.072)	—	—
Policy indicator x quartile 4 of gold mines	—	—	—	0.279***	—	—
	—	—	—	(0.046)	—	—
Number of observations	19,710	19,710	19,710	19,710	13,230	19,710

Legend: * = statistically significant at the 10 percent level; *** = statistically significant at the 1 percent level; 3T = tantalum, tin, and tungsten; — = not applicable; DRC = Democratic Republic of the Congo; SEC = Securities and Exchange Commission.

Table 5: Number of violent events

Dependent variable: number of violent events					
		Poisson (IRR)			
	Poisson (IRR)	**Ordinary least squares**	**Without Kivu Security Tracker**	**Mines, pre-2011**	**2016 and earlier**
Policy indicator	2.528***	0.242	1.963*	1.950*	1.369
	(0.901)	(0.160)	(0.692)	(0.771)	(0.400)
Policy indicator x number of 3T mines	0.994**	0.000	0.994**	0.982	0.997
	(0.003)	(0.002)	(0.003)	(0.024)	(0.003)
Policy indicator x number of gold mines	1.004***	-0.001	1.004***	1.039***	1.006***
	(0.001)	(0.001)	(0.001)	(0.013)	(0.001)
Number of observations	17,739	19,710	17,739	17,739	11,319

Legend: * = statistically significant at the 10 percent level; *** = statistically significant at the 1 percent level; 3T = tantalum, tin, and tungsten; DRC = Democratic Republic of the Congo; IRR = incidence rate ratio; SEC = Securities and Exchange Commission.

Table 6: Number of battles

Dependent variable: number of battles					
				Poisson (IRR)	
	Poisson (IRR)	**Ordinary least squares**	**Without Kivu Security Tracker**	**Mines, pre-2011**	**2016 and earlier**
Policy indicator	2.515**	0.169	2.089*	1.697	1.545
	(1.085)	(0.114)	(0.914)	(0.793)	(0.570)
Policy indicator x number of 3T mines	0.994	0.001	0.995	0.996	0.999
	(0.004)	(0.002)	(0.004)	(0.029)	(0.004)
Policy indicator x number of gold mines	1.006***	0.000	1.006***	1.050***	1.007***
	(0.002)	(0.001)	(0.002)	(0.018)	(0.002)
Number of observations	17,301	19,710	17,301	17,301	10,584

Legend: * = statistically significant at the 10 percent level; ** = statistically significant at the 5 percent level; *** = statistically significant at the 1 percent level; 3T = tantalum, tin, and tungsten; DRC = Democratic Republic of the Congo; IRR = incidence rate ratio; SEC = Securities and Exchange Commission.