Armed Conflict and the Location of Extractive FDI

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Abstract

Extractive foreign direct investment (FDI) constitutes a significant share of global FDI. However, mines are susceptible to insurgent attacks, and there are arguments that these investments may promote civil conflicts. This paper utilizes georeferenced data on armed conflict between 1998 and 2010 in the vicinity of 6,222 mining facilities to investigate the relationship between extractive FDI and armed conflict. I find that foreign ownership has a restraining effect on armed conflict in regions where mining facilities are located. In other words, the presence of foreign-owned mines shapes the location of battles between belligerents. The possibility of military intervention by the home countries discourages both insurgents and national governments to fight in the vicinity of foreign-owned mining facilities. Using a staggered difference-in-differences design with kernel-based propensity score matching, this paper demonstrates that the fear of military intervention outweighs the incentives for armed groups to attack foreign-owned mines. The restraining effect of foreign ownership is further enhanced by the military capabilities of the foreign miners' home country.

KEYWORDS extractive foreign direct investment, armed conflict, spatial dataset, staggered difference-in-differences design

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Introduction

In September 2018, a Colombian rebel faction attacked a gold mine in Yarumal, Colombia. Despite a ceasefire agreement between the counter-insurgency forces and the Revolutionary Armed Forces of Colombia (FARC) in 2016, numerous dissident armed groups continue to target mines to control and exploit mineral resources.[1] Colombian mining facilities are not the only ones at risk of insurgent attacks. In January 2022, the Naxalites, a far-left radical insurgent group in India, targeted bauxite mines in the Gumla district of Jharkhand state.[2] They also attacked coal mines in the Pakur district and mineral transportation facilities in the Bokaro district of Jharkhand.[3] Rebel groups in mineral-rich African countries also frequently engage in battles for control over mines. In the Central African Republic, rebel groups fought for control over diamond mines in Bangassou[4] and the Cooperative for Development of the Congo (CODECO) militants[5] attacked gold mines in Ituri.

A large body of literature suggests that extractive industries are vulnerable to insurgent attacks, and mining facilities may promote civil conflict. Insurgents often attempt to seize oil-drilling operations and pit mining quarries to finance their military actions (e.g. Addison, Le Billon and Murshed 2002; Auty 2001; Berman, Couttenier, Rohner and Thoenig 2017; Buhaug and Gates 2002; Holden and Jacobson 2007; Le Billon 2001). The poorly distributed economic gains from extractive industries also increase grievance-driven conflict (e.g. Collier and Hoeffler 1998, 2004; Fearon and Laitin 2003; Humphreys 2005). Since armed conflict destroys socioeconomic

[1]Reuters. 2018. Continental Gold says three killed in Colombia attack. September 20, 2018 (https://www.reuters.com/article/us-colombia-continental-gold/continental-gold-says-three-killed-in-colombia-attack-idUSKCN1M0284)

[2]The Free Press Journal. 2022. Naxals set over a dozen vehicles on fire being used for mining in Jharkhand's Gumla district. January 8, 2022 (https://www.freepressjournal.in/india/naxals-set-over-a-dozen-vehicles-on-fire-being-used-for-mining-in-jharkhands-gumla-district)

[3]New Delhi Television Ltd. 2009. Naxals strike in Jharkhand; kill mine officials, blow up rail track. October 12, 2009 (https://www.ndtv.com/india-news/naxals-strike-in-jharkhand-kill-mine-officials-blow-up-rail-track-403018)

[4]France24. 2021. Rebels capture Central African diamond-mining city of Bangassou. April 1, 2021 (https://www.france24.com/en/africa/20210104-rebels-capture-central-african-car-diamond-mining-city-of-bangassou)

[5]Reuters. 2022. East Congo rebels kill 35 in raid on artisanal mine. May 9, 2022 (https://www.reuters.com/world/africa/dozens-dead-after-suspected-militia-raid-eastern-congo-2022-05-09/)

infrastructure, increases political instability, and disrupts business operations, the extant literature also warns that armed conflict will reduce inward foreign direct investment (FDI) flows as well as increase divestment (e.g. Bussmann 2010; Collier 1999; Garriga and Phillips 2014; Jensen and Young 2008; Li and Vashchilko 2010; Nigh 1985).

Despite such political risk, however, extractive FDI continues to represent a significant portion of global FDI. In 2003, the value of extractive FDI accounted for approximately 23.5% of the total value of greenfield FDI at its peak. However, this share has declined as major foreign mining companies have entered previously discovered reserves, and the process of discovering new reserves also requires time (UNCTAD 2019). Considering the potential for mining activities to contribute to armed conflict in the areas surrounding their facilities, one may question why foreign miners choose to operate abroad. To be more specific, are these risks acceptable for specific reasons?

The existing literature on greed and grievances has primarily focused on the motives of armed groups while overlooking the cost they incur during conflicts. Although many studies on FDI indicate that gunboat diplomacy has diminished, the potential for foreign intervention to protect their nationals during armed conflicts still exists. Therefore, attacks on foreign-owned mines cannot be equated with attacks on domestic mines, considering the presence of the home government. To explain the continued proliferation of extractive FDI despite the risks of armed conflict, this paper argues that foreign-owned mines have a restraining effect on armed conflicts in the regions where they are located. In other words, the presence of foreign-owned mines influences the geographical distribution of battles between warring factions. One reason is straightforward deterrence: rebel groups refrain from attacking mines operated by foreign corporations to avoid triggering international military intervention. Conversely, national governments, anticipating foreign intervention against local rebel groups, neglect their responsibility to protect foreign mining facilities as such attacks would increase the likelihood of foreign military support. Both the deterrence of rebels and the government's shirking behavior reduce the likelihood of clashes between the two parties, thus decreasing the chances of armed conflict in regions with foreign

mining operations. Furthermore, the restraining effect of foreign ownership is amplified by the military capabilities of the foreign miner's home country. The credibility of foreign military intervention is positively correlated with the military strength of the home country. This theoretical argument implies that FDI not only contributes to economic development and business interests but can also promote peace in conflict zones.

There have been two notable quantitative studies examining the effects of extractive foreign direct investment (FDI) on armed conflict. Mihalache-O'Keef (2018) proposes that extractive FDI exacerbates both greed and grievance mechanisms, leading to an increase in armed conflicts in host countries. However, the country-year level dataset used in the paper fails to convincingly establish a direct link between the onset of civil conflicts and the mining operations of foreign miners. This is partly due to the correlation between the distribution of domestic mines and the share of extractive FDI stock in the country's GDP.

In their analysis of mining facilities for 14 minerals in Africa from 1997 to 2010, Berman, Couttenier, Rohner and Thoenig (2017) suggest that mineral price shocks contribute to an increase in mine value, subsequently heightening the risk of armed conflict. They further observe that this impact is particularly prominent when the level of foreign ownership is higher. However, the authors acknowledge a limitation in their analysis. Their coding approach, which designates a cell as a mining area if a mine operated at any point between 1997 and 2010, fails to account for the possibility that no mining facility was active in a specific area during a given year. Consequently, their findings do not fully capture whether armed conflict was genuinely driven by mining activities, which could vary over time. This issue remains the same in their analysis on the effect of foreign ownership. They calculate the proportion of foreign-owned mines and domestic-owned mines by dividing the number of mines owned by each type of miner by the total number of mines in a specific area. It's worth noting that these values remain consistent within a given area unit across time. Thus, their three-way interaction terms between the price shock, the presence of a mine, and the share of foreign-owned mines cannot fully capture if armed conflict in an area was induced by foreign ownership or simply by the price shock and

preexisting artisanal mines in the region.

To examine the impact of foreign ownership of mining facilities on armed conflict while addressing empirical limitations of early studies, I employ a staggered difference-in-differences design to analyze georeferenced data on armed conflicts occurring between 1998 and 2010 in the vicinity of 6,222 mining facilities across 148 countries. The starting year of operation for each mine serves as the intervention, with foreign-owned mines as the treatment group and domestic mines as the control group. Additionally, I employ a kernel-based propensity score matching strategy to ensure the robustness of the findings. The findings provide evidence that the number of armed conflicts decreases after the entry of foreign miners. The results remain consistent across different distance bands (100 km and 500 km) and casualty thresholds (more than 10 deaths and more than 20 deaths). In addition, the military expenditure of the home country enhances the restraining effect of extractive FDI.

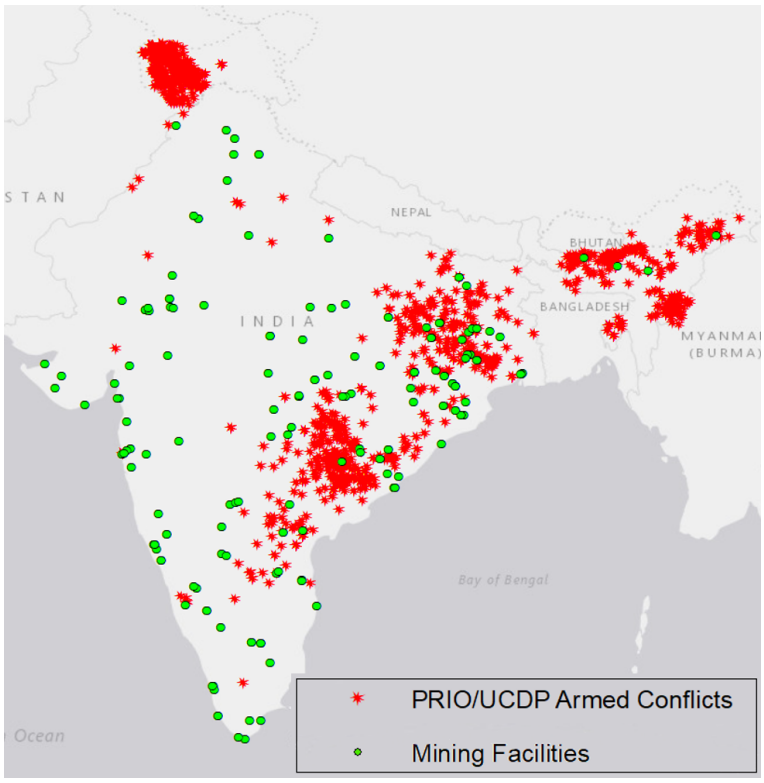
Extractive FDI and Armed Conflict

Between 2006 and 2010, a total of 2,627 armed conflicts took place in India involving the Indian National Army (INA) and various armed groups, including Kashmir insurgents, the Communist Party of India (CPI), the United Liberation Front of Assam (ULFA), and the National Democratic Front of Boroland (NDFB) (Sundberg and Melander 2013).[6] During the same period, there were a total of 188 mining facilities in India, with 172 sites owned by domestic firms and 16 facilities operated by extractive foreign direct investment (U.S. Geological Survey 2010). Of these conflicts, 2,279 incidents occurred within 300 km of mining locations, and 991 incidents occurred within 100 km.

Due to the immobility of their assets, foreign miners frequently opt to make payments to

[6]Based on UCDP Georeferenced Event Dataset (GED) Version 19.1 (Sundberg and Melander 2013) and the U.S. Geological Survey (2010), Figure 1 shows the location of armed conflict and mining facilities in India. GED dataset defines an armed conflict as "an incident where armed force was used by an organized actor against another organized actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date." Figure 10 and Figure 11 in the Appendix presents detailed statistics for 100 km and 300 km distance bands.

Figure 1: Mining Facilities and Armed Conflict in India (2006 - 2010)



armed groups until they decide to withdraw (e.g. Collier 2000; Le Billon 2001). An illustrative example is Lafarge, a French cement corporation, which provided monthly payments exceeding $20,000 to the Al-Nusra Front (an Al-Qaeda affiliate in Syria) in Raqqa (located 90 km south of the factory) and to ISIS in Al-Hasakah (situated 190 km east of the factory) during the Syrian War. These payments were made in exchange for protection, allowing Lafarge to continue operating its cement factory in Syria.[7]

Armed conflict has a severe impact on the economies of affected countries (e.g. Ghobarah, Huth and Russett 2003; Murdoch and Sandler 2002). It leads to the destruction of socioeconomic infrastructure, heightened political instability, and disruptions in business operations, thereby increasing the political risks associated with foreign investment. Consequently, existing literature cautions that armed conflict reduces inflows of FDI and increases divestment. (e.g. Bussmann 2010; Collier 1999; Garriga and Phillips 2014; Jensen and Young 2008; Li and Vashchilko 2010;

[7]Alderman, Liz, Elian Peltier, Hwaida Saad. 2018. "'ISIS Is Coming!' How a French Company Pushed the Limits in War-Torn Syria." *New York Times*. 10 March 2018.

Nigh 1985).

More recent studies suggest that the impact of armed conflict on FDI depends on whether it was anticipated. If a conflict had been expected, FDI flows should not experience a rapid decline once the conflict begins, as multinationals adapt their investment decisions accordingly (Li 2006; Schneider and Troeger 2006). In cases where a conflict is unexpected, the level of uncertainty that persists after its resolution can vary depending on the type of peace agreement reached between the conflicting parties. According to Joshi and Quinn (2018), comprehensive peace agreements and their implementation lower the risk of future conflict. Carter, Wellhausen and Huth (2019) argue that conflicts with clear legal frameworks do not have a negative impact on FDI even before settlement mechanisms are established, as they involve non-disputable legal settlements.

In addition to the uncertainty mechanism, some researchers have found that the expectation of highly profitable investment opportunities can offset the risk of conflict (e.g. Cleeve, Debrah and Yiheyis 2015; Collier 2009; Quinn, Mason and Gurses 2007). In other words, firms may enter a post-conflict country if they anticipate that the potential profits from their investments outweigh the risks associated with the previous conflict, or if they can gather reliable information about the credibility of the host government. Garriga and Phillips (2014) suggest that foreign aid flows to post-conflict countries serve as a signal of government credibility, which attracts FDI when firms lack sufficient information. Similarly, Witte, Burger, Ianchovichina and Pennings (2016) argues that armed conflict has a negative impact on non-resource-related FDI inflows but not on resource-related FDI, due to geographic constraints and the high profitability of extractive industries. While not all production disruptions in one country directly impact the global price of a homogeneous product, Lee (2017) finds in his study of FDI in the petroleum sector that armed conflict can stimulate investment if it leads to an increase in oil prices.

Although the findings of Lee (2017) and Witte, Burger, Ianchovichina and Pennings (2016) suggest that inflows of extractive FDI may not always decrease after armed conflict, it is important to note that they do not claim that extractive FDI carries less risk of armed conflict

compared to other types of FDI. Instead, previous studies have argued that armed groups are more likely to target extractive FDI compared to other types of investments, and the conflict literature has generally assumed a strong correlation between natural resources and armed conflict. The presence of natural resources such as oil, gemstones, and narcotics is believed to create conditions that make armed conflict more likely to occur and persist, through mechanisms related to greed and opportunity. (e.g. De Soysa 2002; Doyle and Sambanis 2000; Fearon 2004; Fearon and Laitin 2003; Hegre and Sambanis 2006; Ross 2004).

Extant studies argue that oil-drilling operations and pit mining quarries are particularly vulnerable to attacks, as insurgents see them as attractive targets for financing their military actionss (e.g. Addison, Le Billon and Murshed 2002; Auty 2001; Buhaug and Gates 2002; Collier 2000; Collier and Hoeffler 1998, 2004; Holden and Jacobson 2007; Le Billon 2001, 2004). Due to the spatial constraints imposed by the geographical distribution of natural resources, extractive industries are more difficult to relocate compared to other industries when faced with the threat of armed conflict. Consequently, they often choose to pay off armed groups as a means of protecting their operations, which further incentivizes armed groups to target and loot mining facilities (Berman, Couttenier, Rohner and Thoenig 2017; Collier 2000; Collier and Hoeffler 1998, 2004; Le Billon 2001, 2004). For the same reason, national governments have strong motives to secure resource extraction facilities (Holden and Jacobson 2007; Le Billon 2001, 2004). As a result, if other conditions remain constant, conflicts between rebels and counter-insurgents are more likely to occur in the vicinity of extraction facilities.

On the other hand, grievance-driven conflict can be fueled by mining operations, as extractive industries often lead to unequal distribution of economic benefits, with only a small group of market actors reaping the majority of the gains while the majority of the population remains impoverished (e.g. Collier and Hoeffler 1998, 2004; Humphreys 2005). Economic inequalities resulting from this disparity disenfranchise the poor and other marginalized groups, creating a sense of relative deprivation that can fuel and support political violence.

Mihalache-O'Keef (2018) argues that the presence of extractive FDI contributes to civil

conflict through both greed and grievance channels. Foreign mining companies extract natural resources using advanced techniques, which increases the value of reserves. However, the benefits from these operations are often captured by a few local elites, while workers are typically poorly paid and subjected to mistreatment. To test her argument, she examines conflict onset at the country-year level and the proportion of sector-specific FDI stock to GDP between 1980 and 2013. Her findings indicate that countries with high FDI stock in primary sectors are more likely to experience armed conflict, whereas countries with high FDI stock in tertiary sectors are less likely to experience civil conflict.

However, these findings do not necessarily indicate that armed conflict occurred because of extractive FDI. Alternatively, her findings could be driven by domestic industries, which was not controlled for. The country-year level dataset which her research relies on also fails to identify the causal effect of foreign miners' mining operations on the onset of civil conflict. Domestic mines could have the same effects on grievance and greed channels as she proposed, and extractive FDI stock as a share of GDP could be high in a country where the domestic mining sector's share of GDP is high. Similarly, a country that attracts more FDI in tertiary sectors should have more skilled labors and better markets for businesses in tertiary sectors, which reduces grievances.

Berman, Couttenier, Rohner and Thoenig (2017) propose that conflict risks surrounding foreign-owned mines increase with global mineral price rises, while there is no significant change in the risks for domestic-owned mines. They argue that the potential rents from seizing mines increase with higher commodity prices, regardless of ownership type. However, national armies are more inclined to protect domestically-owned mines, and domestic miners are less likely to engage in bribery and side payments. Therefore, armed conflicts around mines are mainly driven by the presence of foreign ownership.

Nevertheless, this greater protection by the national army can lead to more battles with insurgent groups, resulting in a higher incidence of armed conflicts around domestic mines. Additionally, there are reports[8] suggesting that armed groups often target artisanal mines more fre-

[8]E.g. OECD. 2015. OECD Guidelines for Multinational Enterprises: Mineral Supply Chains and Conflict Links in Eastern Democratic Republic of Congo. November 19, 2015 (https://mneguidelines.oecd.org/

quently than bigger foreign-owned mines, which are apparently domestic-owned. Since Berman, Couttenier, Rohner and Thoenig (2017) focus on the effects of mine value on armed conflicts, their findings do not directly answer why foreign miners operate in conflict-prone areas as well as whether foreign-owned mines contribute more to armed conflicts than domestically-owned mines.

In addition, their coding approach does not adequately address the possibility of no mining activity in a specific area during a given year. They identify a cell as a mining area if a mine operated at any point between 1997 and 2010. As a result, their findings do not fully capture whether armed conflict was truly driven by mining activities, which could vary over time. This limitation persists in their analysis of the effect of foreign ownership. They calculate the share of foreign-owned and domestic-owned mines by dividing the number of mines owned by each type of miner by the total number of mines in a specific area, which remain consistent within a given cell unit over time.

To address this limitation and provide a more robust analysis of the impact of mining activities on armed conflict, further research is warranted. One possible approach could involve refining the coding methodology to accurately account for years in which no mining facility was operational in a specific area. By accurately identifying periods of mining activity and their absence, researchers can better assess the relationship between mining operations and armed conflict over time. Additionally, employing alternative unit of analysis to gauge the influence of foreign ownership, beyond the proportion of foreign-owned mines, may provide a more comprehensive understanding of the underlying dynamics driving armed conflict in relation to mining activities.

Despite extensive research on the relationship between armed conflict and foreign direct investment, there are still unresolved issues. In the following section, I present a theory that

Mineral-Supply-Chains-DRC-Due-Diligence-Report.pdf), USGS. 2019. Special Geologic Studies: Artisanal and small-scale mining of conflict minerals. January 31, 2019 (https://www.usgs.gov/centers/florence-bascom-geoscience-center/science/special-geologic-studies-artisanal-and-small), and PactWorld. 2020. Reversing 'conflict minerals': Let's formalize artisanal mining for peaceful, just and inclusive societies. December 7, 2020 (https://www.pactworld.org/blog/reversing-%E2%80%98conflict-minerals%E2%80%99-let%E2%80%99s-formalize-artisanal-mining-peaceful-just-and-inclusive).

explores the restraining effect of foreign ownership of mining facilities on armed conflict. This theory also explains the heterogeneous effects of extractive FDI across military capabilities of the home country of investors.

The Restraining Effect of Foreign Ownership

As mentioned earlier, there are two reasons why armed conflict is likely to occur near resource extraction facilities. Both armed groups and national governments have an interest in securing these areas to gain an advantage in civil wars. However, multinational mining enterprises still choose to enter foreign countries despite the risk of armed conflict. This paper argues that foreign investment provides a shield of protection for mining facilities that domestic miners cannot offer.

The key difference between extractive FDI and domestic miners is the home country of the operating entity, although the scale of capital investment and productivity may vary. When mines operated by domestic companies come under attack by armed groups, there is no foreign government that can exercise "protection of nationals abroad" or "diplomatic protection." In contrast, insurgent attacks on mines operated by foreign corporations can potentially trigger military interventions by the home countries of the foreign miners(Burgess 2018; Gaffney 2018; Klosek 2020). Furthermore, some foreign governments indirectly support the national government in the conflict by providing national and international troops against the insurgents (Burgess 2018; Klosek 2019).

For example, the Revolutionary Armed Forces of Colombia—People's Army (FARC) and the National Liberation Army (ELN) had targeted the 780 km-long Caño Limón Coveñas oil pipeline since the 1990s. This pipeline transports 100,000 barrels of crude oil a day from the Caño Limón oilfield which is run by an American oil company, Occidental Petroleum Corporation, to an oil port in Coveñas. Both armed groups continuously bombed many point along the pipeline, and had held battles with the National Army of Colombia occurred around these areas, accordingly. 170 bombings occurred in 2001 which resulted in $500 million of economic losses and the oil

producing facilities had to shutdown for 266 days. Occidental Petroleum spent more than $8.6 million lobbying the U.S. government between 1996 and 2000 to receive military protection[9]. Finally, the US offered $99 million in military aid to Colombia in order to protect the pipeline as well as the Plan Colombia which aimed to combat insurgents and drug cartels in Colombia.[10] After this effort, the bombing of the pipeline declined to 41 times in 2002 which occurred more than 180 km away from the oilfield.

The United States is not the only country which conducts military interventions in the name of diplomatic protection. In 2013, France sent its special forces to secure Areva's uranium mining sites in Imouraren and Arlit, Niger.[11] Areva is a state-owned French nuclear power corporation and the company's mining sites were threatened by AQIM, an Al-Qaeda affiliate, since 2010. Anti-piracy measures in Somalia since December 2008 also can be understood as such interventions by home governments. 26 countries including the US, NATO, other non-NATO European countries, India, China, South Korea, Australia, Russia, Thailand, Malaysia, and Saudi Arabia have participated in this joint military intervention as well as operated independently to protect their investments and international shipping around the Indian Ocean. In 2012, Angola also intervened in conflicts in Guinea-Bissau to protect its nationals' private investments in bauxite and oil production.[12] Russia has intervened through private military companies (PMCs) such as Wagner group, Vegacy, E.N.O.T. Corp, and Vostok Battalion (Cragin and MacKenzie 2020). For example, Wagner group has provided protection for Russian-owned gold mines in Sudan since 2017. These PMCs could be seen as private security forces hired by foreign miners but they are run by Russian oligarchs with close ties to Vladimir Putin and the Kremlin.

Since foreign military support is more likely to occur when foreign miners operate in a

[9]PBS. 2002. Global Reach: U.S. Corporate Interests in Colombia, Frontline World. November, 2002 (https://www.pbs.org/frontlineworld/stories/colombia/corporate.html)

[10]U.S. Government Accountability office. 2005. "SECURITY ASSISTANCE: Efforts to Secure Colombia's Cano Limon-Covenas Oil Pipeline Have Reduced Attacks, but Challenges Remain." GAO-05-971 (https://www.gao.gov/products/GAO-05-971)

[11](Reuters, 2013. France orders special forces to protect Niger uranium: source. January 24, 2013 https://www.reuters.com/article/us-mali-rebels-niger-areva/france-orders-special-forces-to-protect-niger-uranium-source-idUSBRE90N0OD20130124)

[12]Jamestown Foundation. 2012. Military Coup Brings Guinea-Bissau Closer to Narco-State Status. May 4, 2012 (https://www.refworld.org/docid/4fa7a4842.html)

disputed area, national governments may have less incentives to prioritize their responsibility for protecting these facilities over domestic mines. Therefore, instead of focusing on foreign-owned mining facilities, national governments are more willing to allocate their counter-insurgent forces to other war fronts. In addition, domestic mines are typically used as a direct source of war financing (Holden and Jacobson 2007; Le Billon 2001, 2004) but the gains from the foreign-owned mines are generally a tax revenue. This implies that the counter-insurgent and insurgents are more likely to fight over the domestic-owned mines than foreign-owned mines. Hence, the net effect of this incentive structure results in fewer occurrences of armed conflict in regions where foreign miners exist compared to domestic mines.

Some may wonder why there are many examples of rebels attacking foreign-owned mines, as I listed above, while there are fewer reports of attacks on domestic-owned mines. However, as foreigners, we do not often have access to local news that covers rebel attacks on domestic mines. Instead, we are more likely to encounter global news about military interventions by the home governments of mine-owning firms, even if attacks on foreign-owned mines are rarer than attacks on domestic miners. It is important to note that this paper does not claim that foreign-owned mines are completely immune to armed conflict. Armed conflict can still occur near foreign miners' facilities, but it is expected to be less frequent compared to the vicinity of domestic-owned mines. Therefore, the mechanism of the fear of foreign intervention can only be tested by comparing the number of conflicts around foreign-owned mines with domestic-owned mines. To gain further insights, I conducted interviews with five individuals who previously worked in local mines or were immigrants from areas near mining facilities in Africa. They indicated that armed groups often target artisanal mines more directly than mines with foreign ownership. In addition, those artisanal miners are more likely to pay bribes to be secured. Once the national government attempts to protect those mines, armed conflicts arise. While some insurgents may attack foreign-owned mines, it is likely to occur only when these armed groups estimate that the potential benefits outweigh the risks involved.

***Hypothesis* 1.** *Regions where foreign-owned mines are located are less likely to experience armed*

conflict than regions with domestic-owned mines.

Then, under what conditions are foreign miners more susceptible to armed conflict? Foreign miners from countries with stronger military capabilities may be safer than miners from militarily less powerful countries. The mechanism that deters armed conflict in the vicinity of foreign-owned mines is driven by the military projection power of their home countries to protect nationals abroad. The possibility of foreign military support prevents insurgents from targeting extractive FDI and also incentivizes national governments to shirk their responsibility to protect FDI. As a result, the restraining effect of foreign ownership is an increasing function of the home country's military power projection capabilities.

The credibility of a home country's military intervention can also be enhanced by historical reputation building. For example, in the case of the Caño Limón Coveñas oil pipeline, attacks by FARC and ELN ceased after a military intervention conducted by the US, and this effect has persisted to the present. Historical events such as the Cold War and the history of collective security can contribute to granting certain home countries stronger reputations for military intervention. Since these reputations are often correlated with military capabilities, the restraining effect of foreign ownership will be greater when the foreign miner's home country has greater military capability.

***Hypothesis* 2.** *The restraining effect of foreign ownership is greater for firms whose home countries have greater military capabilities.*

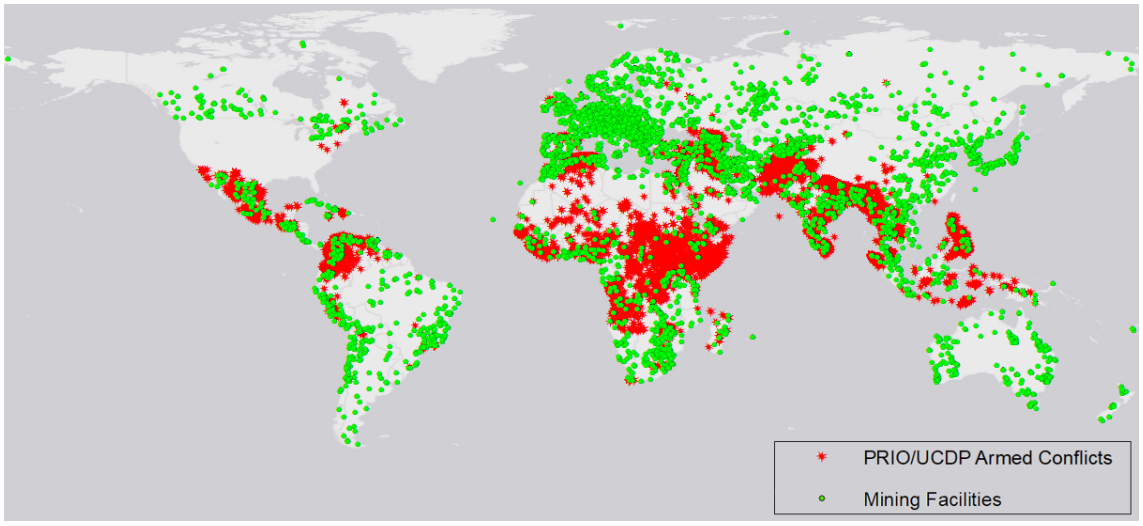
Research Design

Data and Model

Using the UCDP Georeferenced Event Dataset (GED) Global version 19.1 (Sundberg and Melander 2013) and Mineral Operations Outside the United States Data (U.S. Geological Survey

2010), this paper measures the outcome variable, the number of armed conflicts within 300 km of 6,222 mining facilities in 148 countries (excluding the US) reported by the U.S. Geological Survey (2010) as Figure 2 illustrates. Although the most widely accepted definition of an armed conflict is "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths" (Gleditsch, Wallensteen, Eriksson, Sollenberg and Strand 2002), this paper uses all armed conflicts reported in the GED dataset regardless of the number of battle deaths in the analysis because the outcome variable of interest is whether both belligerents are willing to fight in a region where a certain type of mining facility is located.[13] Since the theoretical argument is based on insurgents' incentives to attack foreign-owned mines and national governments' incentives to protect them, in addition, foreign military intervention and interstate war cases are excluded from the analysis.

Figure 2: The Location of Mining Facilities and Armed Conflict



Conflict within 300 km of a mine does not necessarily indicate that the facility has been

[13]The number of battle deaths is shaped by various military factors other than the presence of mining facilities. Restricting samples by the level of casualties could be reasonable if this study was interested in intense battles. The intensity may indicate the level of interest that insurgents and national governments have in such facilities, while one battle death does not necessarily mean that belligerents were substantially less interested in such region. Rather, a battle with at least one casualty still implies that belligerents tried to fight over the region. However, I also report for the robustness check the results using different casualties level (more than 10 deaths and more than 20 deaths) in the Appendix. These findings are consistent with main results of this paper.

directly attacked by insurgents or that a battle between the national government and armed groups directly affects the mining activity. However, this band allows for capturing the number of conflicts that affects the transportation and supply chains of producers of natural resources, which are critical vulnerabilities of extractive industries. 300 km is widely used as the rule of thumb as the most sustainable cost-efficient distance for road-only transport[14] in transport and supply chain studies as well as the threshold between medium and long distance road freight distance[15] in the European Commission. Mining industries tend to set 300 km as a standard maximum distance between land transport supply chains and export ports (e.g. Finch 2012; Lafarge 2012), while the aforementioned case of Occidental Petroleum shows that some commodities that can be transported through tunnels or pipelines have a longer transportation distance. This implies that battles occurring within 300 km likely have potential to negatively affect mining activities.[16]

The U.S. Geological Survey (2010) reports the georeferenced location of 6,409 mining facilities around the world which started operation between 2003 and 2008; the operator of such facilities; the starting years of operation; the types of commodities extracted; and the list of shareholders. After dropping inactive and unidentifiable facilities, the dataset includes 4,702 mining facilities owned by domestic corporations and 1,520 facilities owned by foreign miners from 52 countries.[17] These facilities extract 79 different commodities. Four carbon black, one ozokerite, and eight zeolite mines are excluded due to the lack of price information, which is used as a control variable

[14]Short-sea shipping, railway, and air transportation are considered as an alternative to road-transporation when the distance over 300 km (Vanelslander and Sys 2020).

[15]The European Commission used this threshold in Transport 2050 Plan in 2011 and the consecutive forums. The outline of the plan is available at https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_11_372/IP_11_372_EN.pdf

[16]I also check the robustness of the finding by using different size of distance band (100 km and 500 km) in the Appendix

[17]Foreign-owned facility is defined as a facility operated by at least one foreign corporation. Home country of a foreign miner is coded as the country where the headquarter of a firm's ultimate parent organization is located. The list of home countries is as follows: Algeria, Australia, Austria, Belgium, Bolivia, Brazil, Canada, China, Colombia, Cote D'Ivoire, Egypt, Finland, France, Germany Federal Republic of, Greece, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Kazakhstan, Kuwait, Liechtenstein, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Norway, Panama, Philippines, Portugal, Republic of Korea, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, and Venezuela.

in the analysis.[18] In the dataset, 1,321 facilities' operations are valid since 2003, 219 since 2004, 670 since 2005, 309 since 2006, 3678 since 2007, and 55 since 2008.

A staggered difference-in-differences is applied while leveraging foreign ownership of these mines and their starting year of operation as an identification strategy to capture the causal effect of foreign ownership by comparing the potential number of armed conflicts near foreign-owned mining facilities to that of domestic mines. The dependent variable of this research is the number of armed conflicts within 300 km of a mining facility (i) at a year (t). In the dataset, the maximum number of conflicts is 1,016 which occurred within 300 km of 4 mining facilities in Sri Lanka in 2008. Among the four facilities, two facilities were run by domestic miners (Sri Lanka Cement Corporation and Lanka Phosphate Limited), while the others were owned by Holcim (Switzerland) and Tokyo Cement (Japan), respectively. The average number of conflicts is 8.1, while the median is zero, and the standard deviation is 45.9. The dataset shows that 219 domestic mines and 44 foreign-owned mines experience more than 100 conflicts within 300 km from their facilities.

The intervention variable in this research design is each mine's starting year of operation (T). The pre-operation period in this study consists of 5 years ($T-5$ through $T-1$), while the post-intervention period is T through $T+2$ since 2008 is the latest starting year in the dataset and the U.S. Geological Survey (2010) covers mining operations between 2003 and 2010. As the oldest starting year of operation is 2003, the minimum value of $T-5$ is 1998. To estimate the difference-in-differences, I use the following specification:

[18]The full list of these commodities is as follows: Aluminum, Antimony, Arsenic, Asbestos, Barite, Bauxite, Beryllium, Bismuth, Boron, Bromine, Cadmium, Cement, Cesium, Chromium, Clays, Coal, Cobalt, Copper, Crude Oil, Diamond, Diatomite, Feldspar, Fluorspar, Gallium, Garnet, Gemstones, Germanium, Gold, Graphite, Gypsum, Helium, Indium, Iodine, Iron and steel, Iron oxide pigments, Kyanite, Lead, Lithium, Magnesium, Magnesium compounds, Manganese, Mercury, Mica (scrap and flake), Molybdenum, Natural Gas, Nickel, Niobium (Columbium), Nitrogen, Peat, Perlite, Phosphate, Platinum, Potash, Pumice, Quartz, Rare earths, Rhenium, Salt, Sand and gravel (industrial), Selenium, Silicon, Silver, Soda ash, Sodium sulfate, Stone (dimension), Strontium, Sulfur, Talc and pyrophyllite, Tantalum, Tellurium, Tin, Titanium, Tungsten, Uranium, Vanadium, Vermiculite, Wollastonite, Zinc, and Zirconium

$$\begin{aligned}\text{Armed Conflict}_{i,t} &= \beta_0 + \beta_1 \text{ Foreign}_i + \beta_2 \, T_{i,t} + \beta_3 \text{ Foreign}_i \times T_{i,t} \\ &\quad + \beta_4 \, V_{c,t} + \beta_5 \, W_i + \beta_6 \, Z_{j,t} + \gamma_i + \delta_t + u_i\end{aligned} \tag{1}$$

$\text{Foreign}_{i,t}$ is the dummy variable for foreign ownership of a mining facility i at year t, $T_{i,t}$ is a dummy variable that is 1 for the post-operation period and 0 for the pre-operation period, γ_i is the fixed effect for the administrative division where the mining facility i is located and δ_t is the year fixed effect. The standard errors are clustered at the facility (i) level to allow for observations from different mines to have different variances.

To control for other covariates that could potentially explain armed conflict, the main model specification includes three vectors of control variables: $V_{c,t}$, W_i, and $Z_{j,t}$. $V_{c,t}$ consists of the logged unit price of a commodity c in $t-1$ and annual price growth rate of a commodity c in $t-1$. The commodity price dataset is collected from the IMF Primary Commodity Price System for iron and steel, uranium, coal, natural gas, and spot crude oil[19] and the USGS Historical Statistics for Mineral and Material Commodities in the United States[20]. Since the dataset does not provide specific price information for bromine, fluorspar, niobium, quartz crystal, and vermiculite, I utilize proxy variables to estimate their prices. For bromine, I use salt price as a proxy, as bromine-bearing brines are associated with saline deposits. Gemstone price serves as a proxy for fluorspar, while iron and steel price represents niobium due to its usage in stainless steel alloys along with iron and other elements. Silicon price acts as a proxy for quartz crystal, and mica (scrap and flake) is used as a proxy for vermiculite, given their similar appearance to vermiculite, which is an aluminum-iron-magnesium silicate. To account for variations across different commodities and years, the logged commodity unit price is included in the analysis. Berman, Couttenier, Rohner and Thoenig (2017) utilize this variable as a price shock when

[19]Coal price is measured by the average price of Australian export market and South African export market, and natural gas price is measured by the average market price of Indonesian gas and Netherlands Title Transfer Facility.

[20]Available at https://www.usgs.gov/centers/nmic/historical-statistics-mineral-and-material-commodities-united-states

examining armed conflict induced by the extraction of 14 minerals in Africa between 1997 and 2010. However, it is important to note that this measure cannot be considered appropriate for comparing price shocks across different commodities due to the differing weight units used for liquid commodities (such as natural gas and crude oil) and minerals. Therefore, the inclusion of the commodity price growth rate is necessary to control for changes in the profitability of mining facilities.

Because the location of armed conflict is also strategically chosen based on the geographical feature of potential battlefields, W_i includes the mean, minimum, maximum, and standard deviation of the ruggedness of an administrative division surrounding a facility i. The ruggedness variable is constructed using province-level terrain ruggedness data collected by Shaver, Carter and Shawa (2019).

$Z_{j,t}$ contains host-country level covariates: a dummy variable for past battles within 5 years in host country j in t using GED data, the POLITY score (Marshall, Jaggers and Gurr IV 2012) of a host country j in $t-1$, the GDP per capita of a host country j in $t-1$ and its quadratic and cubic terms, the logged total amount of bilateral foreign aid that a host country j receives in $t-1$, and the political corruption level of a host j in $t-1$. GDP per capita and its growth rate are collected from the World Bank WDI. A nonlinear specification for GDP per capita is included to allow for a general specification of the relationship between armed conflict and national wealth. The total bilateral aid amount variable is constructed by combining two project-level foreign aid datasets collected by AidData: AidData's Core Research Release 3.1 (Tierney, Nielson, Hawkins, Roberts, Findley, Powers, Parks, Wilson and Hicks 2011) and the Global Chinese Official Finance Dataset, Version 1.0 (Dreher, Fuchs, Parks, Strange and Tierney 2017).[21] To control for the political corruption in host countries which can confound the relationship between mining operation and armed conflict, I use regime corruption ($v2xnp_regcorr$) variable in Varieties of Democracy

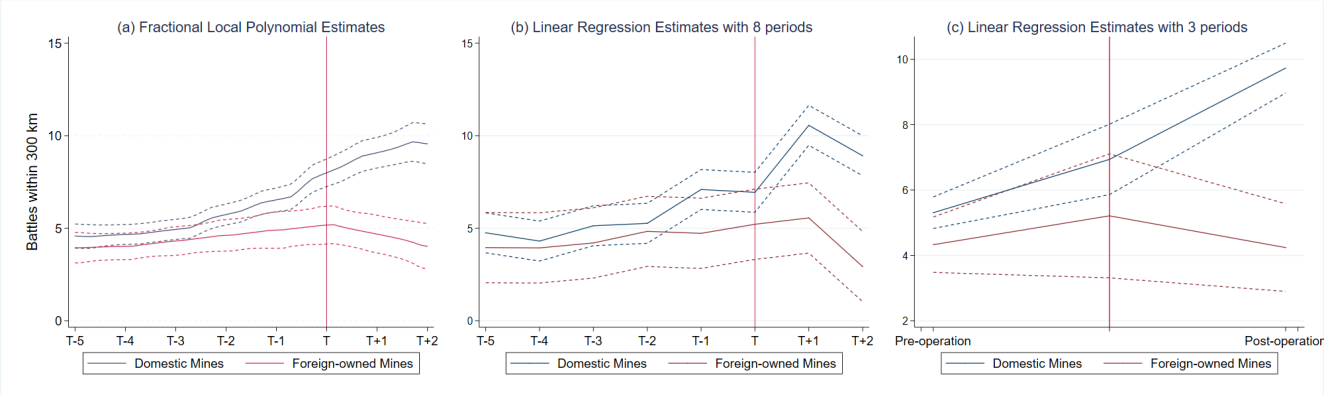
[21] Available at https://www.aiddata.org/datasets. AidData's Core Research Release covers 96 donors' (except China) entire foreign aid projects between 1947 and 2013, and Global Chinese Official Finance Dataset covers Chinese foreign aid projects between 2000 and 2014. For the miscoding issue in OECD Creditor Reporting System (CRS) data, I exclude all of the projects that have negative commitment amount in the constant US dollar.

(V-Dem) Project (Coppedge, Gerring, Knutsen, Lindberg, Teorell, Altman, Bernhard, Cornell, Fish, Gastaldi et al. 2021). This variable measures the extent that political elites use their political power for private gains on a scale from 0 to 1.

Identification Strategy

A difference-in-differences design will successfully identify the causal effect of foreign ownership as long as the parallel trends assumption holds. In other words, the number of conflicts in a region where both domestic and foreign miners enter must have the common average change in the pre-operation period. For example, the parallel trends assumption will be violated if foreign miners enter only in places where the number of armed conflicts decreases over time, but domestic mines are located in regions where the number of conflicts is increasing, and vice versa.

Figure 3: Trends of Armed Conflict Near Mines



The plots in Figure 3 display the trends of armed conflict within 300 km from both types of mines. Plot (a) is constructed by smoothed local polynomial estimates, plot (b) is based on linear regression estimates, and plot (c) also shows the linear estimates using an aggregated period. All of the plots use the estimates from a regression of the number of battles within 300 km from a mining facility in the period, foreign ownership, and their interaction term. For plot (a), I set the maximum degree of fractional polynomial as two. All of these plots have approximately parallel upward trends in pre-operation periods. In addition, the number of conflicts for both groups increases over time until the operation starts and the confidence intervals of these estimates for

both groups overlap each other. This implies that there is no statistically significant difference between domestic mines and foreign-owned mines before they start running these mines.[22]

Table 1: Differences of Means (Pre-Matching)

Original Sample Statistics						
	Domestic Mines		Foreign-owned Mines		Difference	
	μ_0	n	μ_1	n	$\mu_1 - \mu_0$	t-stat
Armed Conflict$_{i,t}$	5.307	23510	4.328	7600	-0.979	1.41
Logged Commodity Price$_{c,t-1}$	5.919	23510	6.274	7600	0.355***	2.87
Δ Commodity Price$_{c,t-1}$	8.532	23510	7.347	7600	-1.185*	3.90
Average Ruggedness$_i$	143.312	23510	113.191	7600	-30.121***	8.40
Minimum Ruggedness$_i$	0.643	23510	0.355	7600	-0.287***	3.96
Maximum Ruggedness$_i$	1519.780	23510	1400.814	7600	-118.967***	4.22
Std. Dev. Ruggedness$_i$	135.098	23510	108.830	7600	-26.268***	10.46
Past Battles within 5 Years$_{j,t}$	0.560	23510	0.478	7600	-0.082***	5.69
POLITY$_{j,t-1}$	4.310	23510	7.133	7600	2.823***	18.59
GDPPC$_{j,t-1}$	14656.23	23510	21049.24	7600	6393.012***	10.45
Logged Aid$_{j,t-1}$	15.268	23510	12.753	7600	-2.515***	9.84
Corruption$_{j,t-1}$	0.471	23510	0.364	7600	-0.107***	11.67

Note: *p<0.1; **p<0.05; ***p<0.01

Table 1 shows the mean differences of the covariates between domestic mines and foreign-owned mines in the pre-operation period. The statistically insignificant mean difference for armed conflict in the table supports the parallel trends assumption. According to the sample statistics, the difference of means of other covariates are statistically distinguishable. GDPPC$^2_{j,t-1}$ and GDPPC$^3_{j,t-1}$ are omitted in this table, but their mean differences are also statistically significant.

The significant mean differences for other covariates may raise flags that the treatment as-

[22]Some may wonder if a region already becomes less riskier before the treatment is implemented due to the anticipation effect of the new foreign-owned mines. In addition, the selection issue that foreign miners tend to choose less risky area also can be questioned. To address these problems, I test the main model with two different measures of the intervention variable for placebo tests: one starts with $t-1$ and the other starts with $t-2$. As shown in Figure 16, the restraining effect of foreign-ownership is not statistically significant when intervention variable includes $t-1$ and the suggested effect disappears when the intervention variable include $t-2$. In other words, the number of armed conflicts in a region where a foreign miner will start an operation in a few years is not affected by the foreign ownership status in the future. I also test if this issue using a set of dummy variables for timing variable from $t-5$ to $t+2$. As shown in Figure 17, the restraining effect becomes significant since the mining facilities start their operation. The margins plot for the original sample also implies that foreign miners may locate their investments at the place where domestic miners tend to avoid due to the high risk, while I leave a full investigation of the positive and significant marginal effects at $t-2$ and $t-4$ for future works.

Table 2: Differences of Means (Post-Matching)

Sample Statistics Weighted by the Kernel-based Propensity Score						
	Domestic Mines		Foreign-owned Mines		Difference	
	μ_0	n	μ_1	n	$\mu_1 - \mu_0$	t-stat
Armed Conflict$_{i,t}$	3.970	23510	4.328	7600	0.358	0.57
Logged Commodity Price$_{c,t-1}$	6.211	23510	6.274	7600	0.063	0.47
Δ Commodity Price$_{c,t-1}$	7.447	23510	7.347	7600	-0.100	0.35
Average Ruggedness$_i$	116.830	23510	113.191	7600	-3.639	1.02
Minimum Ruggedness$_i$	0.389	23510	0.355	7600	-0.034	0.61
Maximum Ruggedness$_i$	1392.371	23510	1400.814	7600	8.443	0.27
Std. Dev. Ruggedness$_i$	111.160	23510	108.830	7600	-2.329	0.92
Past Battles within 5 Years$_{j,t}$	0.472	23510	0.478	7600	0.007	0.45
POLITY$_{j,t-1}$	7.091	23510	7.133	7600	0.042	0.33
GDPPC$_{j,t-1}$	21098.18	23510	21049.24	7600	-48.940	0.07
Logged Aid$_{j,t-1}$	12.739	23510	12.753	7600	0.015	0.05
Corruption$_{j,t-1}$	0.366	23510	0.364	7600	-0.002	0.21

Note: *p<0.1; **p<0.05; ***p<0.01

signment is associated with the distribution of these confounders. Therefore, this paper adopts a kernel-based propensity score matching strategy to address the effect of non-random assignment of the foreign ownership of mines. One advantage of the kernel-based propensity score matching over one-to-one propensity score matching is that this method adjusts the balance by constructing weights based on the distance between individual data points from the control group and the counterfactual outcome without reducing the sample size. Therefore, the sample can achieve as-if randomization with the full information of the dataset and lower variance. When estimating the propensity score, the Epanechnikov distribution is used with all covariates in $V_{c,t}$, W_i, and $Z_{j,t}$. $V_{c,t}$. Table 2 shows that the mean values of the covariates across the treatment and control groups are well-balanced after matching. GDPPC$^2_{j,t-1}$ and GDPPC$^3_{j,t-1}$ are omitted in this table. Their mean differences are also statistically insignificant. In addition, the number of armed conflicts of domestic mines before the operation starts becomes smaller than that of foreign-owned mines, which implies that the post-matching sample is free from the possible selection effect that foreign miners tend to choose safer places. This difference was not statistically significant in the pre-matching sample.

Findings

The main result is presented in Table 3. Model 1 estimates the difference-in-differences without the weight constructed by the kernel-based propensity score, while Model 2 is estimated with the weight. In both models, the difference-in-differences has a statistically significant negative coefficient, while the restraining effect of foreign ownership is smaller in Model 2 than Model 1. This implies that foreign miners experience fewer armed conflicts within 300 km of their mining facilities than domestic mines, confirming Hypothesis 1.[23]

The logged price of a commodity that a mine extracts has a positive coefficient but is not significant in either models, while the growth rate of the commodity price has a statistically significant positive coefficient in the model with the kernel weight. This result implies that the price shock measured by growth rate increases the incentives for attacking mines. In other words, insurgents consider the profitability of mining facilities when deciding which regions to target.

Among the four different measures of terrain ruggedness, only the negative coefficient for minimum ruggedness is statistically significant in Model 1. This implies that an armed conflict is more likely to occur in an area with more mountains and hills than open plains. GDP per capita has a significant negative effect on armed conflict. This indicates that wealthier countries have fewer armed conflict than poorer countries. The quadratic term of the variable has a very small positive coefficient, while the cubed term has a very small negative coefficient. This implies that the restraining effect of GDP per capita on armed conflict decreases slightly as GDP per capita increases. The logged total amount of bilateral aid and political corruption in the host country are shown to increase armed conflict.

The plots in Figure 4 provide a visual representation of the impact of foreign ownership, based on the estimates derived from Model 2.[24] The left plot illustrates the changes in the number of battles within a 300 km radius of mining facilities for both domestic miners and foreign miners

[23] **??** in Appendix shows the results from both Model 1 and 2 using African samples. Both plots show that African samples also show the similar pattern, which implies that Berman, Couttenier, Rohner and Thoenig (2017)

[24] Note that similar patterns are observed when considering estimates from Model 1 (See Figure 13 in the Appendix.)

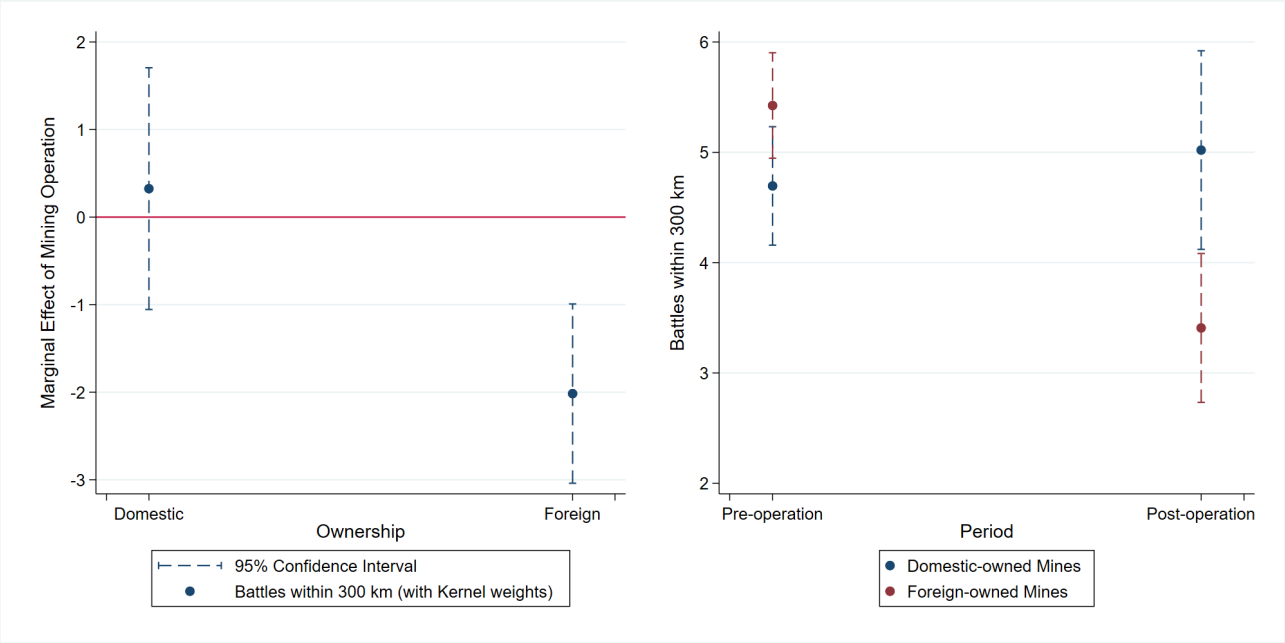
Table 3: Foreign Ownership and Armed Conflict

	Model 1	Model 2
	Pre-matching	Post-matching
$\text{Foreign}_{i,t}$	0.966***	0.729**
	(0.370)	(0.361)
$T_{i,t}$	-0.006	0.325
	(0.548)	(0.704)
$\text{Foreign}_{i,t} \times T_{i,t}$	-2.825***	-2.341***
	(0.855)	(0.826)
Logged Commodity $\text{Price}_{c,t-1}$	0.023	0.009
	(0.021)	(0.023)
Δ Commodity $\text{Price}_{c,t-1}$	0.005	0.008***
	(0.003)	(0.003)
Average Ruggedness_i	-0.007	-0.003
	(0.009)	(0.019)
Minimum Ruggedness_i	-3.418**	-1.135
	(1.680)	(1.124)
Maximum Ruggedness_ie	.0003	0.0004
	(0.0004)	(0.0009)
Std. Dev. Ruggedness_i	0.006	0.0008
	(0.010)	(0.0177)
Past Battles within 5 $\text{Years}_{j,t}$	0.199	0.329
	(0.335)	(0.314)
$\text{POLITY}_{j,t-1}$	0.945*	0.197
	(0.487)	(0.234)
$\text{GDPPC}_{j,t-1}$	-0.003***	-0.001***
	(0.001)	(0.000)
$\text{GDPPC}^2_{j,t-1}$	0.000***	0.0003
	(0.000)	(0.0000)
$\text{GDPPC}^3_{j,t-1}$	-0.000***	-0.000
	(0.000)	(0.000)
Logged $\text{Aid}_{j,t-1}$	-0.001	0.015*
	(0.014)	(0.008)
$\text{Corruption}_{j,t-1}$	42.122***	37.275***
	(10.275)	(11.000)
Constant	-25.400***	-25.756***
	(6.820)	(7.785)
Observations	49776	49776
Adjusted R^2	0.50	0.55
Administrative Division FE	Yes	Yes
Year FE	Yes	Yes

Note: Entries in parentheses are standard errors clustered at facility (i).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

after the commencement of their operations. The findings indicate that the number of battles near domestic mines does not exhibit a significant difference compared to the pre-operation period. In contrast, areas near foreign-owned mines experience an average of approximately 2

Figure 4: The Effect of Foreign Ownership (Model 2)



fewer battles per year after the start of their operations, in comparison to the pre-operation period.

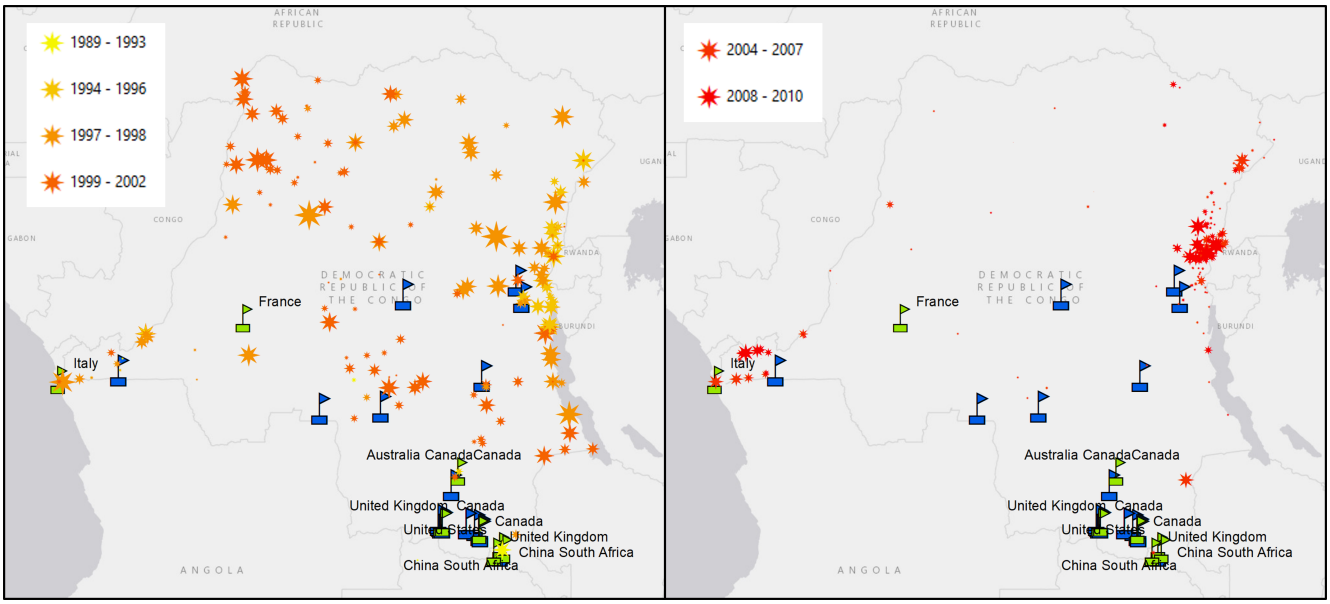
The plot on the right demonstrates that regions where both domestic and foreign-owned mines are expected to be located experience an average of around 5 to 6 battles within a 300 km radius before operations commence. Conversely, during the operation period, areas with domestic mines still encounter approximately 5 battles, whereas areas with foreign-owned mines witness a decline to approximately 3 battles. Domestic mines do not demonstrate any significant restraining effect, as the confidence intervals between the pre-operation and operation periods overlap. This implies that the observed difference is not statistically significant. These results remain consistent when considering different casualty levels (more than 10 deaths and more than 20 deaths) as well as different distance bands (100 km and 500 km) (See Figure 14 and Figure 15 in the Appendix).

If the statistical finding holds true, there should be a noticeable shift in the geographical distribution of armed conflict following the entry of extractive foreign direct investment. Figure 5 provides a visual representation of the tendency for insurgents to avoid regions where

foreign-owned mines commence operations in the Democratic Republic of Congo (hereinafter Congo). The roots of the Congo civil war trace back to the 1960s, originating from a dispute between Belgian mining firms that had controlled the country during colonial times. The Belgian miners had a vested interest in secession, particularly in the southern area of Congo where mines and sponsored armed groups that temporarily divided the region were situated. Upon Congo's independence from Belgium in 1960, Belgian miners sought to maintain their mining rights in the country. As a result, Belgium supported secessionists in the regions of Katanga, which housed Belgian-owned copper mines, and South Kasai, known for its diamond fields. Following United Nations intervention, American miners entered the scene, eventually replacing the Belgian investors through an agreement that involved US foreign aid to the Mobutu administration. Maurice Tempelsman of Lazare Kaplan Diamond took control of diamond mines in the Kasai region, while American copper miners operated mines in Katanga. For a decade, Congo experienced relative peace until the collapse of copper prices in 1975 and the occurrence of oil crises. Consequently, American copper miners withdrew from Congo, and Katangan rebels based in Angola invaded Congo in 1977 and 1978. Given the presence of Belgian and French miners invited by Mobutu in the region, Belgium and France deployed troops and defeated the rebels. Throughout the Cold War era, the US continued to support Mobutu through foreign aid, which accounted for nearly half of USAID's assistance to sub-Saharan Africa. However, once the Cold War ended, Mobutu's relationship with the US underwent a radical shift, and civil war erupted as the likelihood of US intervention diminished.

Both maps in Figure 5 portray the locations of armed conflict during various periods. In the dataset used for analysis, all mining facilities in Congo initiated their operations in 2003. The green flags represent the locations of foreign-owned mines, while the blue flags represent domestic mines. All conflict incidents are represented by explosion symbols, with more recent conflicts depicted in red and older conflicts in yellow. The size of the symbols reflects the level of casualties. Additionally, the labels next to foreign-owned mines indicate the home country of the foreign miners.

Figure 5: Armed Conflict in the Democratic Republic of the Congo



The map on the left depicts the distribution of armed conflict in Congo during various periods before 2003, including the Second Congo War between 1998 and 2003. It shows wide dispersion and numerous battles occurring in regions where foreign miners would later establish their operations. In contrast, the map on the right indicates that there are fewer conflicts in proximity to foreign-owned mines, despite the region's long history of conflict and the presence of valuable minerals.

Heterogeneous Effects of Foreign Ownership

Hypothesis 2 suggests that the restraining effect of foreign ownership is conditional on the military capability of the foreign miners' home country. It claims that foreign-owned mines will be safer than domestic mines when their home country has stronger military capabilities. To test this Hypothesis, I replace the foreign ownership variable in the baseline model (Model 2) with the military capability of the foreign owner's home country. Military capability is measured by the amount of military expenditure in billions of British Pounds based on National Material Capabilities (v5.0) published by the Correlates of War Project (Singer and Stuckey 1972). Because both belligerents make decisions after observing the past year's military capability of the home

country, I lag the military expenditure variable by one year. In cases where a mining facility (i) is run by multiple foreign miners from different countries, this variable is coded as the maximum military expenditure among the home countries. The model specification is as follows:

$$\begin{aligned}\text{Armed Conflict}_{i,t} &= \beta_0 + \beta_1 \text{ Mil. Exp.}_{i,t-1} + \beta_2\, T_{i,t} + \beta_3 \text{ Mil. Exp.}_{i,t-1} \times T_{i,t} \\ &+ \beta_4\, V_{c,t} + \beta_5\, W_i + \beta_6\, Z_{j,t} + \gamma_i + \delta_t + u_i\end{aligned} \tag{2}$$

Figure 6: The Effect of Military Capability of Home Country

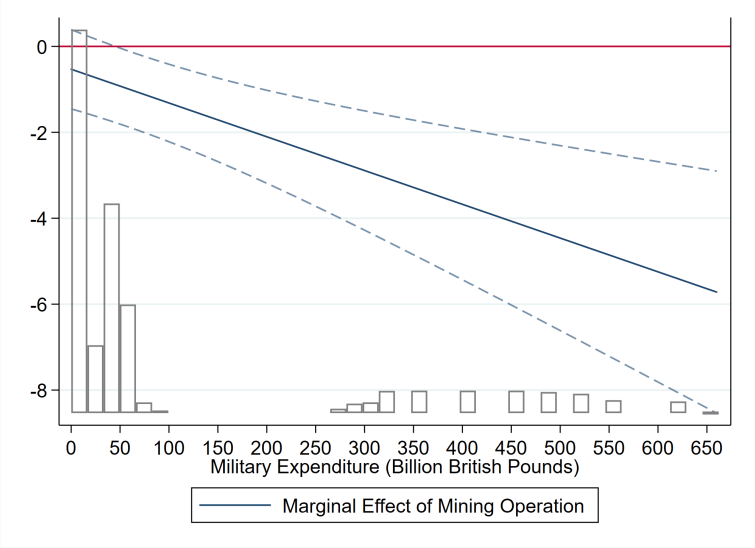
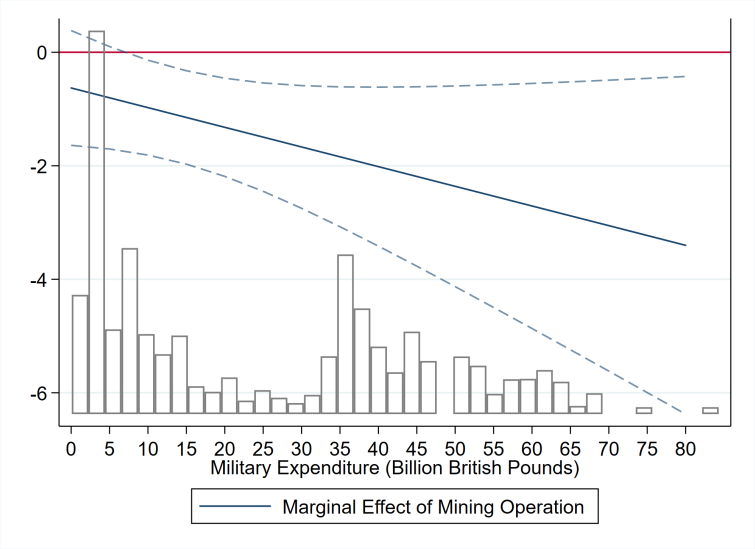


Figure 6 shows the marginal effect of the mining operation when the amount of the foreign miners' military expenditure varies.[25] It clearly shows that foreign-owned mines have the greater restraining effect when the mine owners' home countries spend more on military expenditure, which is consistent with Hypothesis 2.

The histogram overlaid on the margins plot visualizes the distribution of military expenditure. In the dataset, the military expenditure of the US is greater than 270 billion British Pounds since 1998, while the second largest military expenditure is spent by China in 2004 (84 billion British Pounds). Hence, to check if the result is driven by American miners, I estimate the model after excluding 284 mines that are owned by US firms, which is shown in Figure 7. The

[25]Tables for the estimates are presented in Table 5 in the Appendix.

Figure 7: The Effect of Military Capability of Home Country
(mines owned by American miners are excluded)



result after the exclusion is consistent with the result before the exclusion, while the statistical significance of the pre-exclusion result is sightly greater. Figure 7 suggests that foreign miners from a country spending more than 40 billion pounds per year prevent about 2 armed conflicts in regions, while the right plot shows that this effect decreases by about 0.035 when the country cuts its military spending by 1 billion pounds.

Alternative Explanation: Bribery and Mercenary

Although the findings introduced above provide statistical evidence that foreign ownership of a mine reduces the risk of armed conflict in a region and that this effect depends on the military capabilities of the foreign miners' home country, some may wonder about alternative mechanisms that may prevent armed conflict in a region. One possible alternative explanation is that foreign miners may bribe armed groups. As the aforementioned case of Lafarge illustrates, Collier (2000) and Le Billon (2001) suggest that foreign miners frequently provide armed groups with side payments in exchange for preserving their business. By paying armed groups, foreign miners may be able to prevent immediate plundering and looting.

However, bribing does not guarantee the safety of business operations. In the case of Lafarge, many workers had been kidnapped by armed groups for ransom. When the Kurds kidnapped 9 employees in 2012, the firm had to pay €200,000 to release them and the size of the payments subsequently increased. When Lafarge concluded that the demands of ISIS were no longer affordable, ISIS attacked the Lafarge cement factory and killed over 50 employees in September 2014. In addition, appeasing armed groups with bribery also does not necessarily mean that there will be fewer battles between rebels and counter-insurgents. Armed groups may use payments from foreign miners to strengthen their militants, and those increased military capabilities may increase the likelihood of battles against national armies. On the other hand, the counter-insurgents' rational expectation of this mechanism increases the possibility of preventive attacks against rebels around foreign-owned mining facilities. Thus, it is not clear whether the net effect of bribery should be to increase or decrease the number of battles in regions where an extractive FDI is located.

The other alternative explanation of the restraining effect of foreign miners is mercenaries hired by foreign mining corporations. For example, Shell spent about $75 million on private security firms in 2009 to protect its facilities in Nigeria. It spent a total of $383 million in security expenditure between 2009 and 2011, including payments to both Nigerian national security forces and private mercenaries.[26] Richards (2006) suggests that there are hundreds of private military and security companies including Aegis Defence Services, ArmorGroup, Blackwater, Booz Allen Hamilton, Control Risks, DynCorp, Erinys, Military Professional Resources (MPRI), Intercon Security, L-3 Communications, Northrop Grumman, Raytheon, and Vinnell, which provide mercenaries to multinational mining corporations such as Anvil Mining, BHP Billiton, BP, Chevron, De Beers, ExxonMobil, Shell, Siemens, and Texaco. By hiring these private security forces, foreign miners may deter possible attacks on their facilities.

However, these private security forces often engage in human rights violations (Holden and Jacobson 2007; Le Billon 2013; Renner 2002) in regions where foreign mining facilities are located,

[26]Hirsch, Afua, and John Vidal. 2012. "Shell spending millions of dollars on security in Nigeria, leaked data shows." *The Guardian*. 19 Aug 2012.

which has been suggested as a cause of armed conflict near foreign-owned mines. In addition, the presence of strong security forces does not guarantee a perfect deterrence. Instead, those mercenaries can be involved in direct battles near mining sites, which in turn increases the number of battles in the region. As a result, the net effect of mercenaries hired by foreign miners also becomes unclear.

To evaluate these two alternative explanations, this paper estimates the effect of the foreign miners' firm size on armed conflict. Sizable firms should be able to afford a substantial amount of bribes to armed groups as well as employ effective mercenary forces to secure their facilities. If firm size does not have a statistically significant restraining effect on armed conflict, this implies that the mechanism leading to restraint is not related to the firm's own activities, such as employing bribery or mercenaries. To estimate the effect of firm size, I use the number of foreign mines owned by foreign miners in t as a proxy measure, which is added to Model 1 and 2 as a control variable.[27] Since the collinearity between the foreign ownership variable and the foreign miners' firm size variable can increase the standard errors, I also test this effect by using the subset of foreign-owned mines while including the interaction term between the firm size and the intervention variable, which can be represented as follows:

$$\begin{aligned} \text{Armed Conflict}_{i,t} \; &= \beta_0 + \beta_1 \text{ Firm Size}_{i,t} + \beta_2 \; T_{i,t} + \beta_3 \text{ Firm Size}_{i,t} \times T_{i,t} \\ &\quad + \beta_4 \; V_{c,t} + \beta_5 \; W_i + \beta_6 \; Z_{j,t} + \gamma_j + \delta_t + u_i \end{aligned} \tag{3}$$

The result is shown in Table 4. Columns for Model 6 and 7 are the test results of Model 1 and 2, respectively, after adding firm size as a control variable. In both the pre-matching and post-matching samples, firm size does not have a statistically significant coefficient, implying that firms that are more capable of bribing and hiring mercenaries do not necessarily experience more or less armed conflict in regions where their facilities are located. The plots in Figure 8 show the effect of foreign ownership on armed conflict when controlling for the firm size of foreign

[27] In the dataset, foreign miners have 8.5 foreign facilities on average. The largest foreign miner in terms of the number of foreign mining facilities is Rio Tinto (85) since 2007, which is followed by Holcim (78) since 2008.

Table 4: The Effect of Firm Size

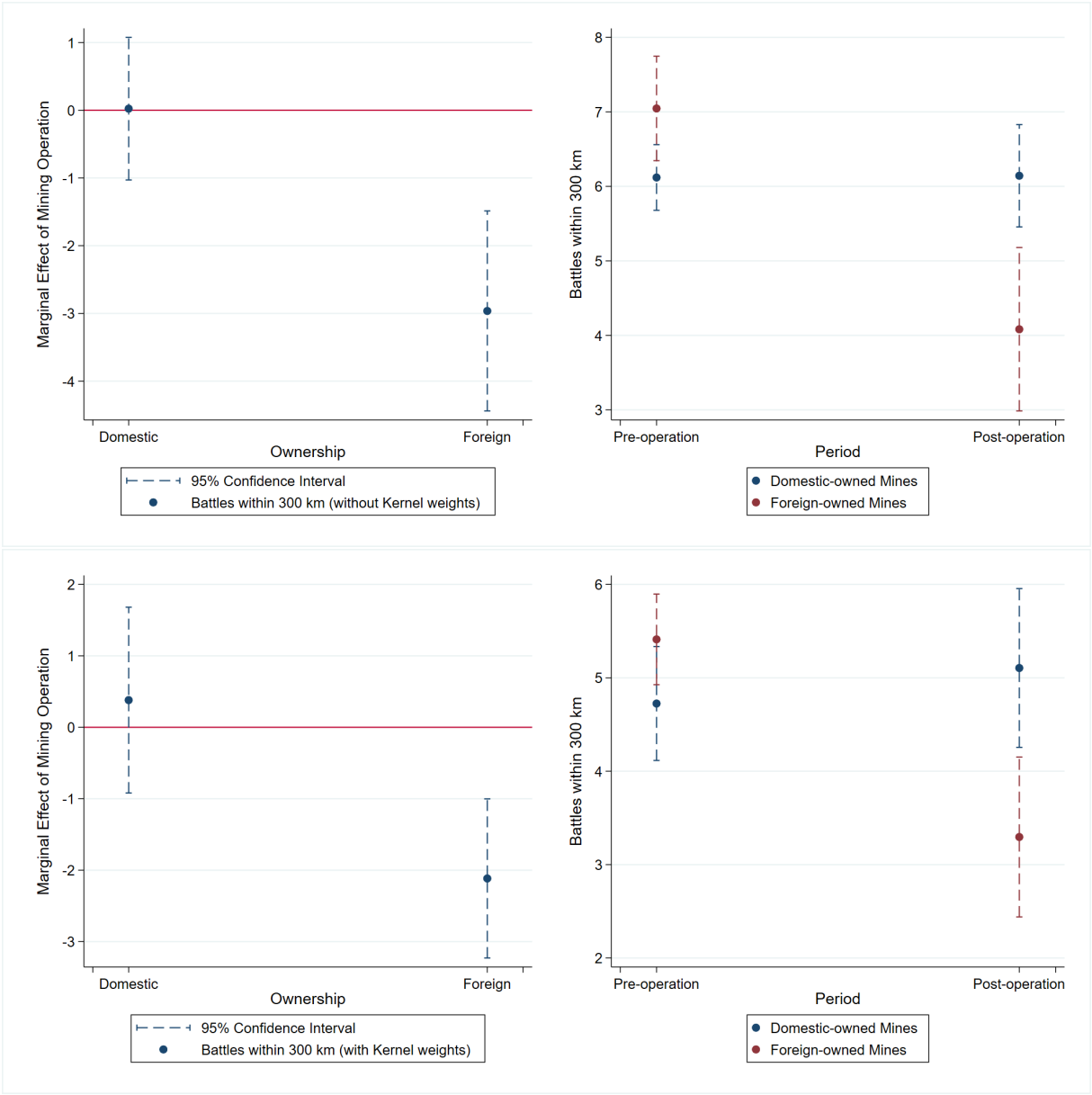
	Model 6	Model 7	Model 8
	Pre-matching	Post-matching	Foreign-owned Mines
$\text{Foreign}_{i,t}$	0.927**	0.687*	
	(0.412)	(0.409)	
$\text{Firm Size}_{i,t}$	0.009	0.008	-0.030
	(0.023)	(0.024)	(0.026)
$T_{i,t}$	0.023	0.381	-1.063
	(0.537)	(0.663)	(1.113)
$\text{Foreign}_{i,t} \times T_{i,t}$	-2.987***	-2.496***	
	(0.799)	(0.777)	
$\text{Firm Size}_{i,t} \times T_{i,t}$			0.033
	(0.878)		(0.050)
Constant	-25.398***	-25.770***	-7.789
	(6.824)	(7.905)	(10.910)
Observations	49776	49776	12160
Adjusted R^2	0.501	0.548	0.592
Controls	Yes	Yes	Yes
Administrative Division FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: Entries in parentheses are standard errors clustered at facility (i).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

miners. The two plots on the top represent the estimates of Model 6 and the other two plots on the bottom are for Model 7. These plots look very similar to Figure 4 and Figure 13, indicating that the main result holds even when controlling for firm size of foreign mining corporations.

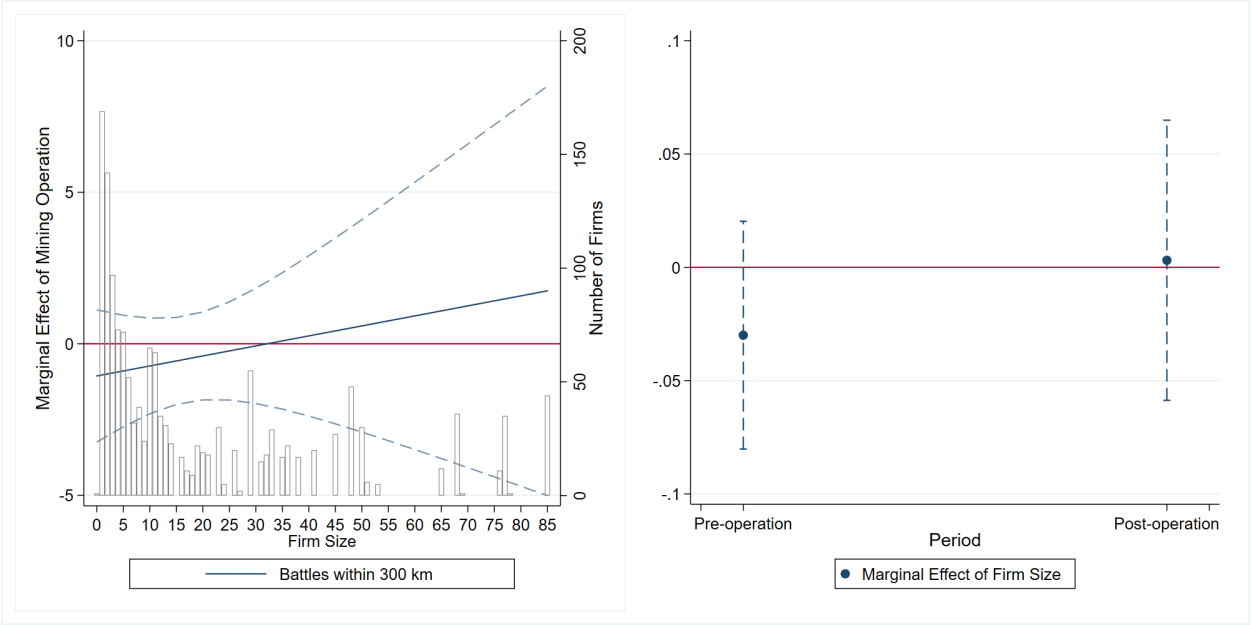
Model 8 tests the marginal effect of firm size in the post-intervention period. The coefficient for firm size is negative but statistically insignificant, while that of the interaction term is positive but insignificant. Since the absolute value of the latter is greater, the firm size variable has a positive effect on armed conflict in the post-operation period, while the statistical significance of the net effect is not clear on the table. Figure 9 visualizes the marginal effect across different values of firm sizes and operation period. The plot on the right shows that the effect of firm size on the number of armed conflicts in regions where foreign-owned mines are located is statistically insignificant. These results reject the restraining effect of bribing and mercenary mechanisms on armed conflict. The plot on the left shows the effect of mining operation when firm sizes vary, and the histogram on the plot indicates the distribution of firm sizes in the starting year of the

Figure 8: The Effect of Foreign Ownership with Firm Size Control (Model 6 and 7)



operation ($t = T$). Both plots imply that the capability of bribing insurgents and hiring mercenaries do not produce a restraining effect. Rather, the capability may increase the frequency of battles in these regions.

Figure 9: The Effect of Firm Size (Model 8)



Conclusion

The literature on the relationship between armed conflict and foreign direct investment (FDI) has been growing. Existing research suggests that armed conflict reduces FDI inflows. In addition, the greed and grievance literature argues that mining industries increase the risk of armed conflict near mining facilities. However, these studies do not explain the continued proliferation of extractive FDI despite the risks of armed conflict. In contrast, this paper provides an explanation of how foreign ownership of mines prevents armed conflict in regions where mining facilities are located.

This paper focuses on the the fear of military intervention by home governments of foreign miners. Even if foreign-owned mines serve as attractive targets for insurgents, attacking mines operated by foreign corporations can provoke international military intervention. This expectation of foreign intervention acts as a deterrent for armed groups targeting the vicinity of foreign-owned facilities, while also making national governments less inclined to engage in conflict in those areas. As both belligerents become less willing to fight in the vicinity of foreign-owned mines, extractive FDI has a restraining effect on armed conflict. The likelihood

of intervention is influenced by the military capabilities of the foreign owner's home country, further strengthening the restraining effect.

Using a difference-in-differences design with georeferenced data on armed conflict near 6,222 mining facilities, this paper provides empirical evidence supporting these arguments. The findings are robust across alternative measures of the outcome variable, and the study strengthens identification by employing a kernel-based propensity score matching method.

This paper contributes to the literature on FDI and armed conflict in three ways. First, it fills a gap in the literature by investigating the relationship between armed conflict and FDI. While there is extensive research on the impact of armed conflict in host countries on future FDI flows (e.g. Bussmann 2010; Carter, Wellhausen and Huth 2019; Cleeve, Debrah and Yiheyis 2015; Collier 2009; Garriga and Phillips 2014; Jensen and Young 2008; Joshi and Quinn 2018; Lee 2017; Li 2006; Li and Vashchilko 2010; Nigh 1985; Quinn, Mason and Gurses 2007; Schneider and Troeger 2006), less attention has been given to understanding how FDI affects conflict and why multinational corporations enter conflict zones. By using georeferenced data on conflict locations and mining facilities, this paper examines the risks faced by foreign-owned mining facilities and the conditions that make them less likely to be targeted compared to other mining facilities.

Second, this research uses causal inference methods to rule out various alternative explanations as well as to address empirical limitations in early studies. The existing literature on FDI suffers from endogeneity issues between FDI and other political economic factors. Since FDI decisions are made after accounting for the expectations concerning the political economy of host countries and changes in those variables, it is hard to establish a convincing causal relationship. Parallel trends between the location of domestic mines and foreign-owned mines in pre-operation periods allow this paper to identify the treatment effect of foreign ownership. In addition, kernel-based propensity score matching provides as-if randomization.

Third, the empirical findings of this study show that foreign-owned mines do not induce more armed conflict in a region. Previous studies suggest that extractive FDI are more susceptible

to armed conflict since foreign firms have incentives to pay side payments to armed groups. Foreign-owned mines may also boost popular grievances through their operations, which in turn induces armed conflict (e.g. Holden and Jacobson 2007; Le Billon 2001). On the other hand, my research demonstrates that there exists a restraining effect of foreign ownership of mining facilities on the incidence of armed conflict. More recently, many foreign miners put more effort on corporate social responsibility regarding conflict resolution and peace building in conflict zones (e.g. Ballentine and Nitzschke 2004; Slim 2012). In addition to these efforts, this paper sheds light on the international mechanism for foreign-owned mines to restrain armed conflict.

Appendix

Figure 10: Armed Conflict Affecting Mines in India (2006 - 2010, within 100 km)

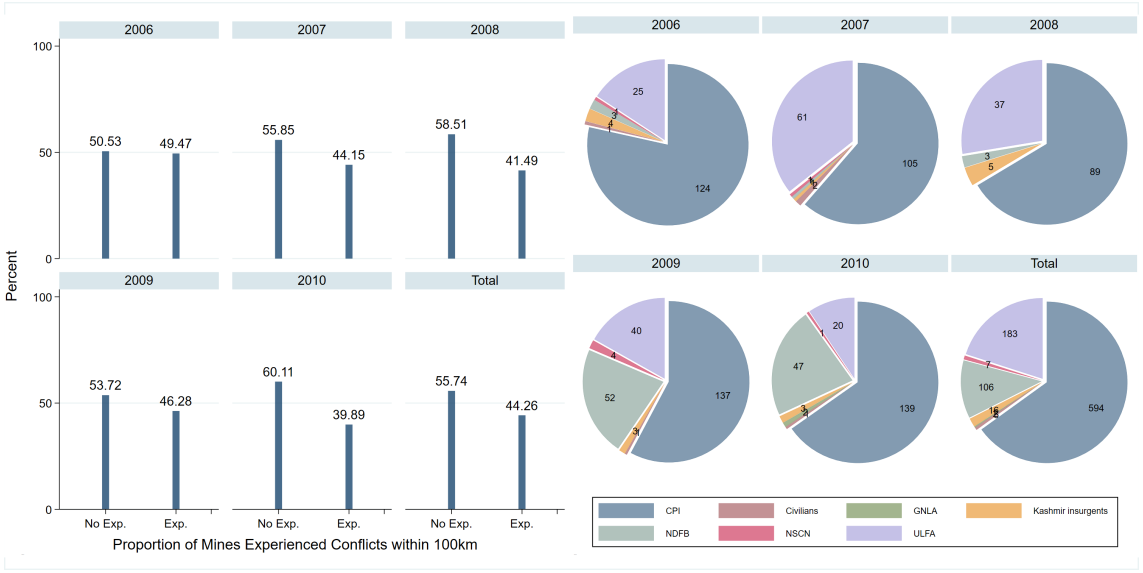


Figure 11: Armed Conflict Affecting Mines in India (2006 - 2010, within 300 km)

Figure 12: Logged Commodity Price and Armed Conflict (Model 2)

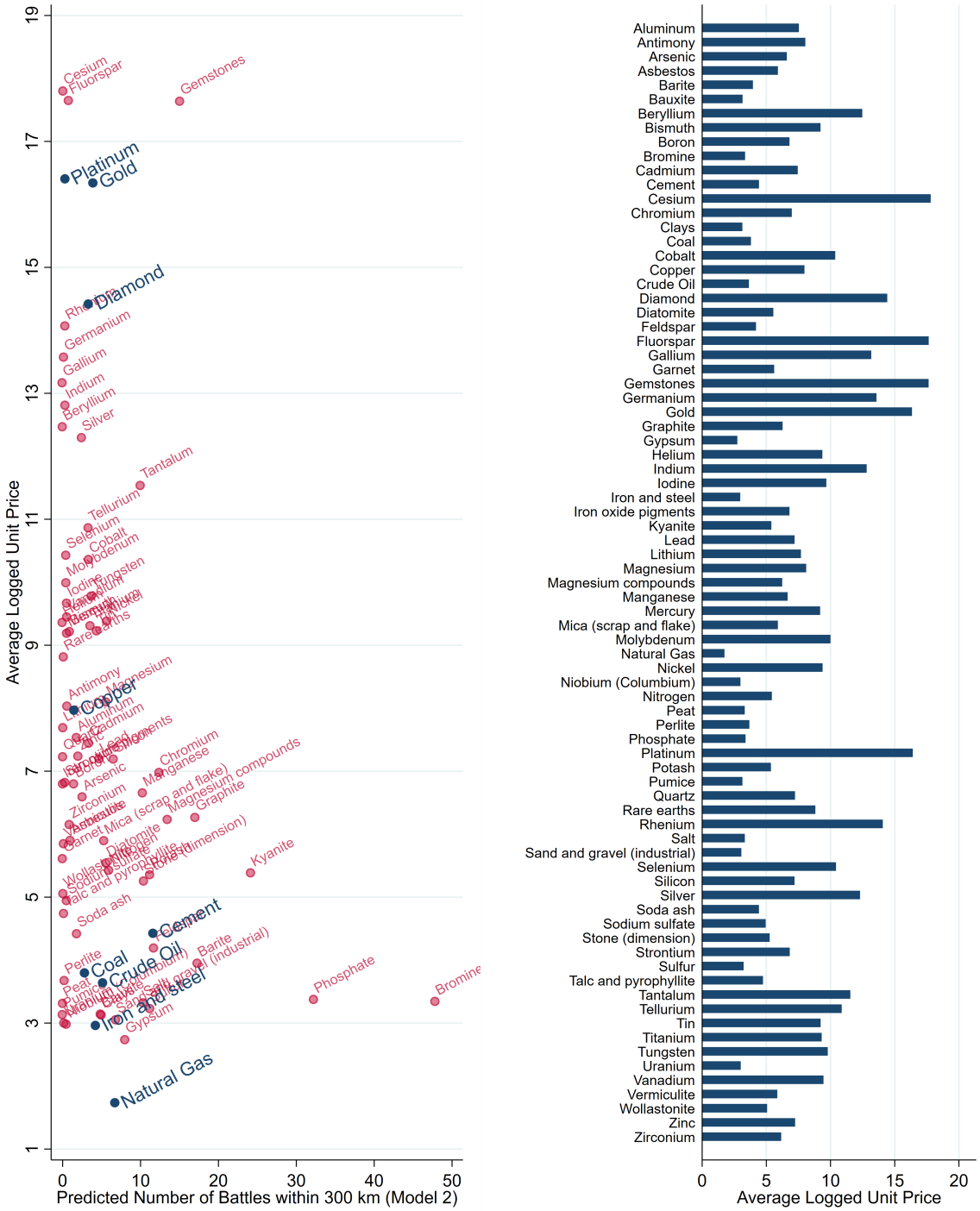


Figure 13: The Effect of Foreign Ownership (Model 1)

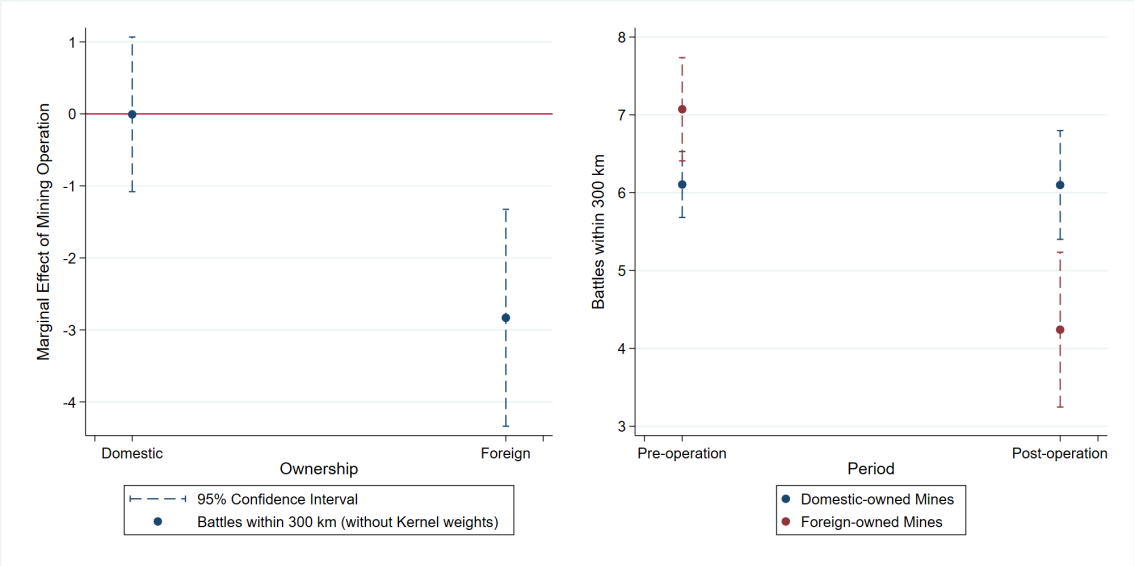
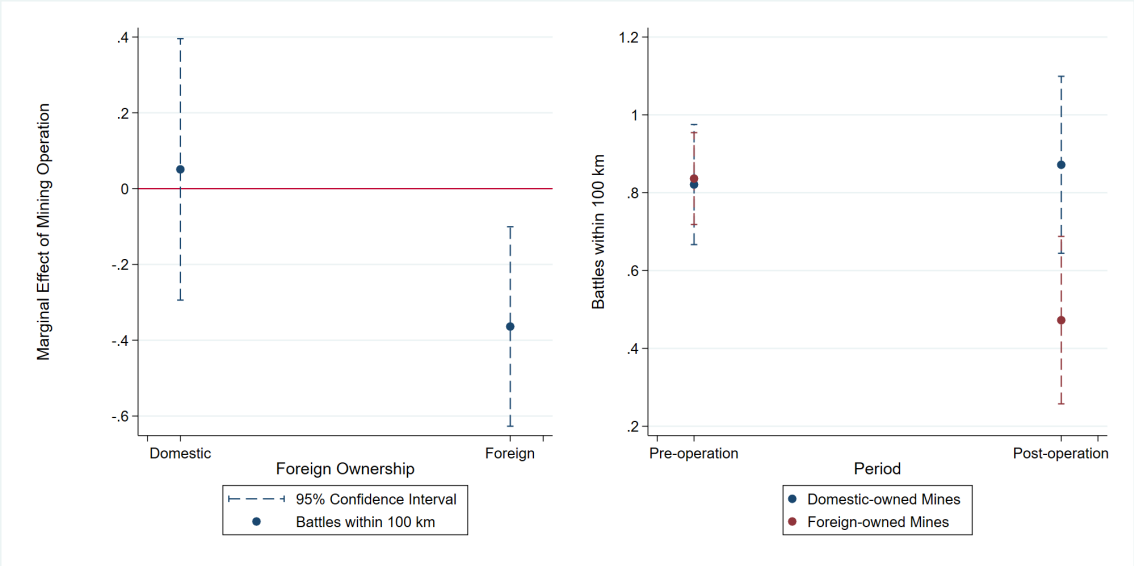


Figure 14: The Effect of Foreign Ownership (Model 2, by Distance Band)



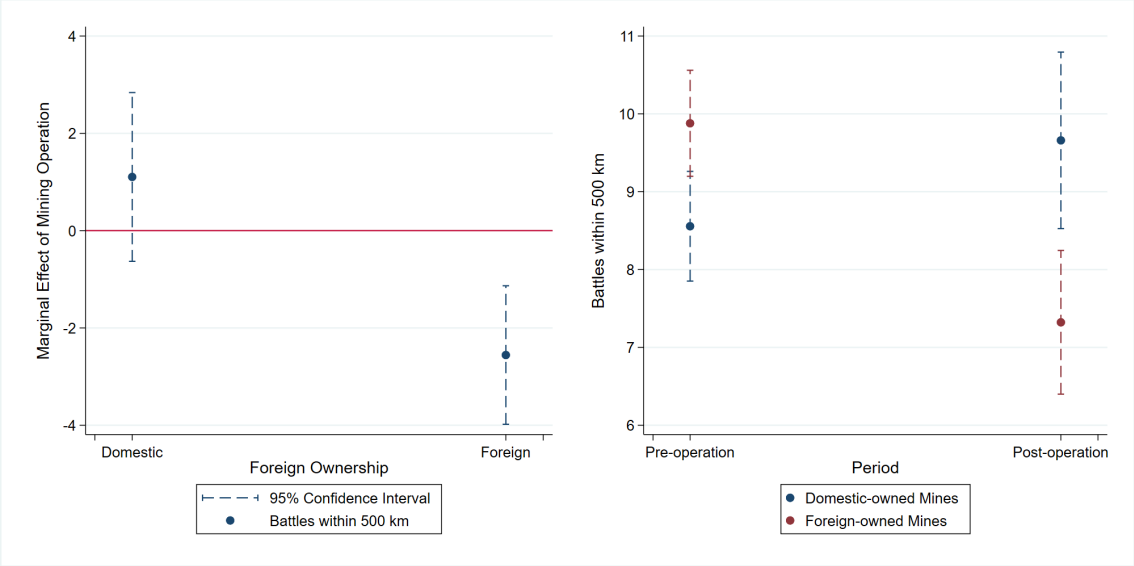


Figure 15: The Effect of Foreign Ownership (Model 2, by Casualties Level)

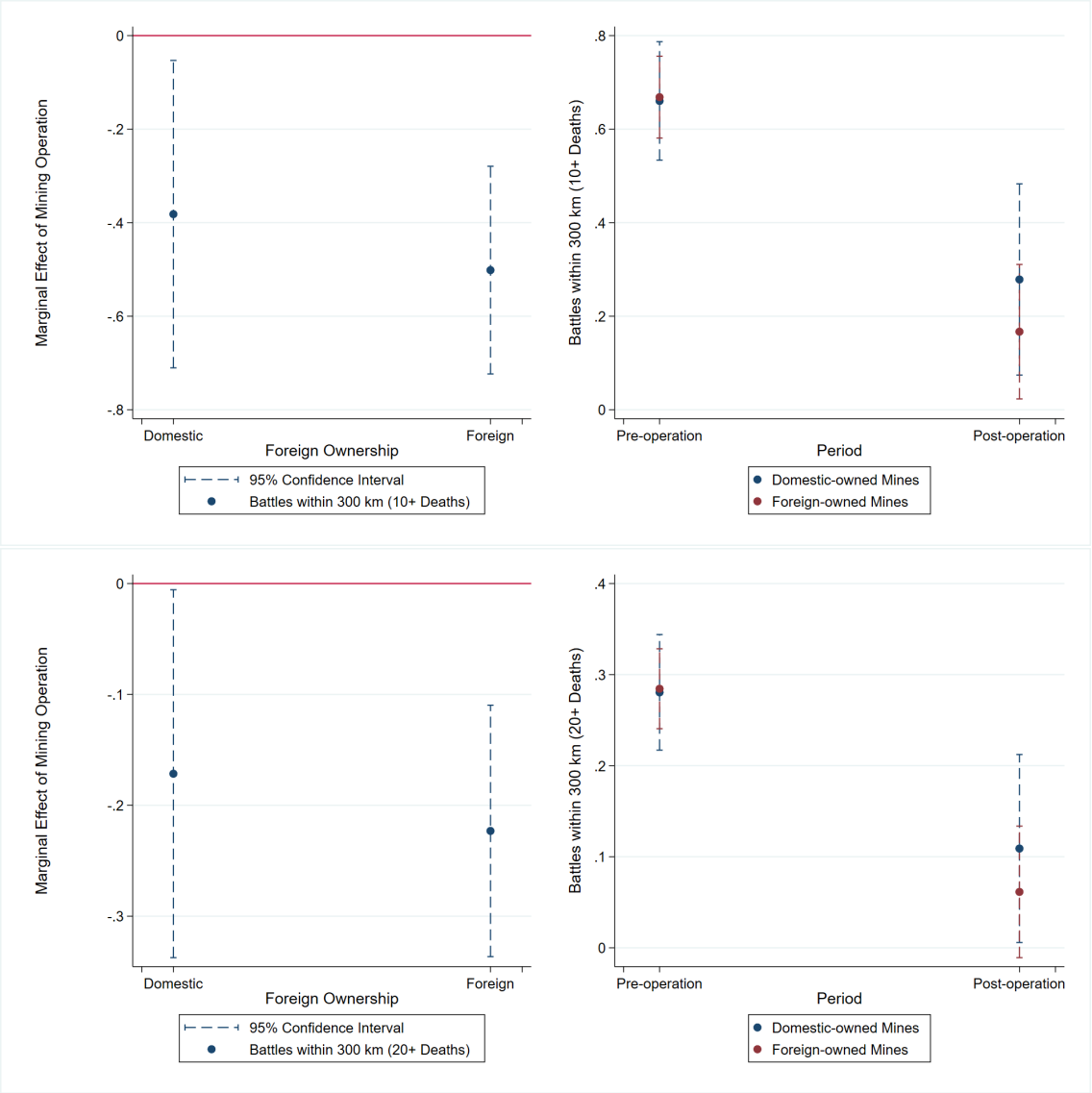


Figure 16: The Effect of Different Intervention Timing (Model 2)

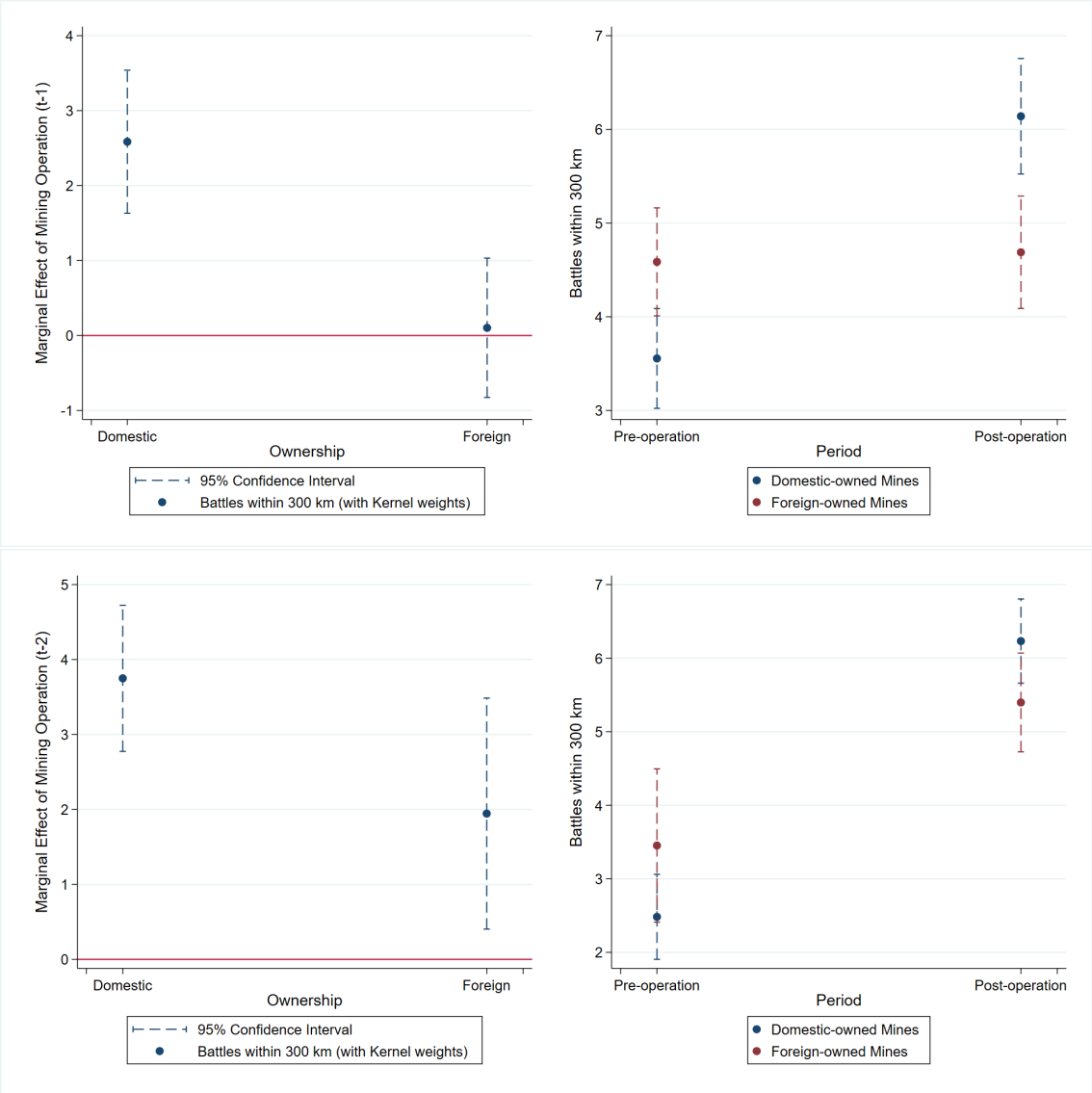


Figure 17: The Effect of Foreign Ownership at Different Timing

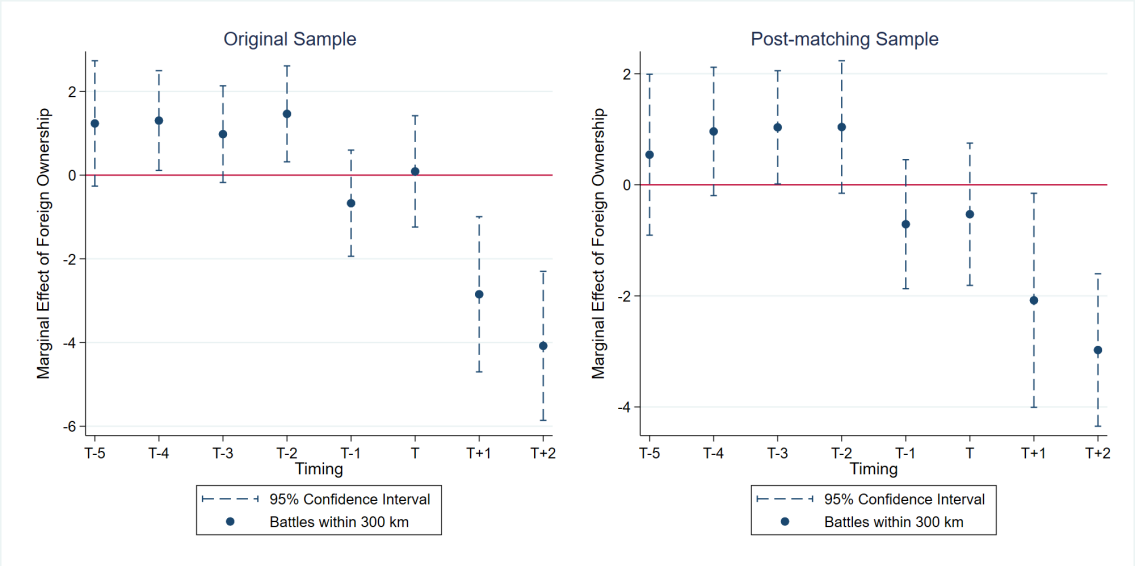


Table 5: The Effect of Military Capability of Home Country

	Model 3	Model 4
	Full Samples	Samples Excluding the U.S.
Mil. Exp.$_{i,t-1}$	0.003***	0.017
	(0.001)	(0.011)
$T_{i,t}$	-0.531	-0.629
	(0.471)	(0.516)
Mil. Exp.$_{i,t-1} \times T_{i,t}$	-0.008***	-0.035
	(0.002)	(0.022)
Constant	-25.544***	-26.490***
	(7.892)	(8.645)
Observations	49776	47504
Adjusted R^2	0.548	0.546
Controls	Yes	Yes
Host Country FE	Yes	Yes
Year FE	Yes	Yes

Note: Entries in parentheses are standard errors clustered at facility (i).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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