Game-Theoretic Analyses of US Settlement Allowing for Coercion and Activism*

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Abstract

Previous game-theoretic analyses of the settlement of the United States assume that Indigenous peoples and settler colonizers either engaged in free exchange or total war for land. We reframe the model to break the binary and consider that violence, including coercion, was present in most of their interactions; that is, we allow for the settler colonizer to engage in coercion to strategically lower their appropriation costs for Indigenous peoples' lands. We also extend the model to include activism on behalf of Indigenous peoples. Our paper provides insights for historical and ongoing land-use disputes between the state and Indigenous peoples, and acknowledges the enduring societal structure of settler colonialism. We find that the settler strategically uses violence to pay less in exchanges for Indigenous peoples' lands, and that cost-reducing activism on behalf of Indigenous peoples reduces settler-state violence while it increases the compensation they receive for their land.

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JEL Codes: $C7$, $D63$, $D74$, $K10$, $N41$

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1 Introduction

The settler-colonial project in the United States (US) has perpetrated violence against Indigenous peoples from its origin.[1] In economic assessments of the interactions between Indigenous peoples and settler colonizers, the structural violence of settler colonialism remains formally under-addressed. Moreover, the connections between the manifestations of the structural violence in that time and its manifestations today are under-studied in the discipline. There exist no formal game-theoretic analyses considering that structural power imbalances subvert equitable economic interactions between Indigenous peoples and the US settler state.

In our paper, we utilize game theory to address the following question: How do coercion and activism influence settler-colonial violence, Indigenous resistance, and compensation in land exchanges? Similar to Anderson and Mc Chesney (1994), we focus upon the strategic behavior of settlers and Indigenous peoples during the settlement of what is now known as the US. However, we incorporate, with a formal theoretic approach, what Kades (2000) discusses: that a range of strategic coercive tactics were employed by colonizers belonging to "the regime of efficient expropriation" of Indigenous peoples' lands in what became the US. He argues further that these tactics were employed to undermine free exchange. To our knowledge, this study is the first game-theoretic analysis of US settlement to formally consider that the settler-colonizers' actions before land exchanges strategically undermine consent.

The economic literature that our paper relates to is the theoretic conflict literature including, for example, analyses such as Hirshleifer (1988), Powell (2002), and Acemoglu et al. (2012).[2] However, the most closely related economic analysis to our own is Anderson and

[1] The US government's relations with Indigenous peoples are dominantly exploitative, extractive and coercive (see Grande (2015, pp.30)). As, Benson (2020) discusses, "coercion is a form of violence." Even when interactions avoided outright war, they are often characterized by inherent structural violence.

[2] See Kimbrough et al. (2017) for a review of these and other conflict models in economics.

Mc Chesney (1994); they employ game theory to demonstrate that the evolution of the level of violence between US settlers and Indigenous peoples can be exclusively explained by economic incentives. Aside from Anderson and Mc Chesney (1994), our paper is the only formal game-theoretic analysis to examine the levels of violence between the US settler state and Indigenous peoples. In contrast to Anderson and Mc Chesney (1994), however, we are not primarily concerned with determining whether economic costs and benefits can predict when land exchanges will devolve into outright battles for the land. Instead, we are concerned with the violence and coercive tactics preceding negotiation for the land. Similar to Hirshleifer (1988), though using a different approach in a unique context, we allow for coercion to be present even when all-out conflict or war is avoided. Hirshleifer (1988) and many of the analyses that followed in the conflict literature in economics use the "guns versus butter" type models, but we instead focus on the appropriative efforts exclusively. We incorporate a similar concept of coercion to that described by Powell (2013) and modify its manifestation in our model to adapt it to our question. We also provide some understanding of the "trigger of conflict," in the context of exchanges between a settler-colonial regime and Indigenous people, that Kimbrough et al. (2017) discuss is an avenue for contribution in models of conflict.

We draw from a multitude of disciplines[3] by infusing our economic analysis of the interactions between the US settler-colonial institution and Indigenous peoples with terms and considerations for coercion and power. A specific and critical understanding that we maintain is that settler colonialism is a persisting societal structure.[4] Dunbar-Ortiz (2014a)

[3]These include Indigenous studies, critical ethnic studies, anthropology, sociology, history, critical geography and settler-colonial studies, to name some. We do so in recognition of the understanding that leaving systemic discrimination unacknowledged in economic theory, and so the policies it informs, at best undermines any efforts to eliminate structural inequality and often contributes to policies that enact further harm.

[4]Settler colonialism is, according to Rowe and Tuck (2017) "The specific formation of colonialism in which people come to a land inhabited by (Indigenous) people and declare that land to be their new home...[it] is about the pursuit of land, not just labor or resources...[and] is a persistent societal structure, not just a historical event or origin story for a nation-state." A key feature of settler colonialism, as Wolfe (2006) identifies it, is its, "logic of elimination." As Wolfe (2006) states, "Settler colonialism destroys to replace...[it] is

provides historical analysis and concludes that, "the history of the US is a history of settler colonialism." By directly addressing that the formation and maintenance of the US settler state is characterized by coercion, we address a critical and formally unconsidered dynamic in game-theoretic analyses of US settlement. In doing so, we follow Arruda (2016)'s prescription for economics to directly name and address axes of oppression.

Economics is well-suited to examining certain components of settler colonialism. This is in part due to settler colonialism centrally concerning the strategic acquisition of land. Even where it is not the primary focus of economic analysis, it is critical that settler colonialism, and its persisting inequitable consequences, be acknowledged in the discipline. Kendi (2016) demonstrates in his analysis of US history, that self-interest, including economic self-interest, begets racially discriminatory policies that lead to the formation of racist ideas. McCoy (2014) provides a land education analysis of settler colonialism that describes how in Jamestown, Virginia, US, economic self-interest lead to a policy of removal of Indigenous peoples and ultimately to correspondingly problematic ideology. Anderson and Mc Chesney (1994) conclude that economic incentives can explain why battles occurred during US settlement. Similar to all of these analyses, we find that economic self-interest can be a sufficient catalyst for violence against Indigenous peoples, even when land is exchanged without resorting to all-out war. Our paper is the only game-theoretic analysis to incorporate understandings of settler colonialism and to consider that violence was employed even in the interactions between the settler state and Indigenous peoples that avoided outright seizure of the land. K-Sue Park (2015) traces the legacy of conquest in the US, including settler colonialism, and describes how it endures in US legal institutions. Using a game-theoretic

an inclusive, land-centred project that coordinates a comprehensive range of agencies, from the metropolitan centre to the frontier encampment, with a view to eliminating Indigenous societies." The importance of the logic of elimination to settler colonialism is perhaps most intuitive when one considers its most simplified form; namely, "settler society required the practical elimination of the natives in order to establish itself on their territory" (Wolfe, 2006). For additional details, other helpful sources include: Allen (2019), Arruda (2016), Benson (2020), Brown-Perez (2017), Dunbar-Ortiz (2014a), Kendi (2016), McLaren (2015), K-Sue Park (2015), and Rowe and Tuck (2017).

approach, we similarly consider that the system of settler colonialism continues to influence interactions today.

We examine a complete-information sequential-move game of a representative interaction between a settler-colonial regime and Indigenous people wherein the settlers seek to acquire the Indigenous people group's land. We include a structural power imbalance in the model and allowances for the US settler-colonial state to coerce the Indigenous people group with whom they interact. The structure of the game consists of four main stages: first, the settlers arrive upon the land of the Indigenous people and engage in some level of violence against them; second, the Indigenous people group resists that violence; third, the settler government proposes a compensation offer for the land; and fourth, the Indigenous people group decides whether to accept or reject the offer. If they reject the offer, the interaction escalates to all-out conflict over the land whereby there exists a probability that either side will succeed. As a benchmark case we also analyze the context in which there is no coercion or resistance (e.g., the first and second stage are removed). Lastly, we include an extension of the game that allows for cost-reducing activism on behalf of the Indigenous people. This extension permits the examination of the role that activism may have in mitigating the inequity in US settler-colonial state interactions with Indigenous peoples today.

Our results indicate that the settler colonizers utilize violence to reduce the amount that they have to compensate Indigenous peoples in land exchanges. This aligns with Kades (2000)'s argument that the US strategically undermined voluntary exchange to facilitate least-cost expropriation of Indigenous peoples' land; specifically, it is in accord with the assertion in Kades (2000) that the colonial regime primarily engaged in threats and weakening of Indigenous peoples by systematic settlement (resulting in among other things, thinning of game and spreading of disease) in order to acquire their lands in a cost-effective manner.[5]

[5]Kades (2000) provides as examples several legal policies and "discounting policies" that encouraged this strategic settlement (e.g., the policies of "compact settlement," "the rectangular survey system," and the Homestead Acts) that "enhanced the spread of endemic diseases and thinned game rapidly." Additionally, Kades (2000) discusses the devastating effects of game-thinning at the frontier and particularly refers to

As Veracini (2011) explains, "Colonialism is primarily defined by exogenous domination. It thus has two fundamental and necessary components: an original displacement and unequal relations." Our paper reflects that it is essential in a game-theoretic analysis of US settlement to discuss the implications of the unequal distribution of power between players and to acknowledge, like Banner (2007) emphasizes, that even when land is exchanged without outright battle, it is critical to consider coercion and power. By expanding the choices of the settler state to allow for coercion, our findings call into question whether consent was possible surrounding many of the land exchanges between Indigenous peoples and settlers. This result further provides a lens with which to view current structural violence maintained in interactions between the US government and Indigenous peoples in, for example, legal settlements (K-Sue Park, 2015). We discuss several historical examples in order to contextualize the comparative statics that correspond with our equilibrium outcomes. For example, we provide discussion of historical events that correspond with the results indicating that settler violence is decreasing in the marginal cost of settler violence and increasing in the marginal cost of Indigenous resistance.

Another main result of this analysis is that a land exchange between a settler colonizer and Indigenous people is more likely to avoid all-out conflict if the monetary benefit of the land for the settler is greater than the weighted Indigenous people group's connection to the land.[6] This provides an additional perspective to consider when speculating about the factors contributing to the increase in all-out conflicts as US settlement reached further west. While Anderson and Mc Chesney (1994) consider that it is likely that differing institutional structures between Indigenous peoples living in the east versus the west (e.g., purportedly

multiple Indigenous people groups for whom the depletion of game was an explicit strategy employed by the colonizers and/or mentioned by the Indigenous people as harmful. Those Indigenous peoples specifically referred to include: the Mohegan, the Cherokee, the Choctaws, and the Piankashaws.

[6]This relationship is weighted by the Indigenous people's economic dependence upon settler institutions. Greater economic dependence makes it more profitable for the settler to make an acceptable offer for the land. This implies that if the Indigenous people is more economically dependent upon the settler society, then the settler group is less likely to engage in outright seizure of the land.

poorly defined property rights of certain Indigenous peoples) drove the increase in formal battles between settlers and Indigenous peoples, our finding offers additional points of consideration. For example, we find that if an Indigenous people is linked more closely with the land, then this triggers more preemptive settler violence which could partially explain the increase in explicit conflicts. Another possible driver could be that the settlers may have had a relatively lower capacity to make the Indigenous peoples more economically dependent upon settler institutions in those exchanges where conflict escalated.

Our paper also demonstrates that cost-reducing activism on behalf of Indigenous peoples helps to reduce the settler violence they face. Even when the power imbalance is maintained, if there is increased activist support, then Indigenous peoples can both resist more (which in turn reduces the harm that the violence brings) and the settler reduces their violence level.[7] This is relevant for activists who seek to mitigate harm in modern land disputes between Indigenous peoples and the US settler state.

Section 2 contains the descriptions of the basic structure of the game and the two specific versions of the game (with and without coercion), along with a brief reporting of their respective results. In Section 3, we extend the coercion game to incorporate cost-reducing activism on behalf of Indigenous peoples and discuss the results. Finally, Section 4, consists of a summative conclusion for the entire analysis.

2 Model

We examine a complete-information sequential-move game with representative players for an Indigenous people and a settler-colonizing group.[8] The central model is a simplified

[7] An example of this is when veterans came alongside the water protectors, who were experiencing police brutality while protesting the Dakota Access Pipeline's construction on unceded lands of the Standing Rock Sioux Tribe.

[8] Though for simplicity we often refer to the settler-colonizing power with whom the Indigenous people group interacts as the settler colonizer or simply the settler, this is shorthand for the entirety of the US settler-colonial project (including the government, militias, and individual settlers, etc.) To emphasize that

representation of the interaction between these two groups in the context of the formation of the settler colonial state of the US; specifically, our analysis focuses upon the engagement between the two groups immediately preceding a settler colonial regime's attempt at land acquisition. The model, in addition to providing insights for that particular context, can also be understood to represent a structural game between a settler-colonial agent and Indigenous people in more general contexts. This section focuses on the engagement between the two wherein the settler colonizer attempts to behave in a way to facilitate appropriation of an Indigenous people's land (either by exchange or attempted seizure).

Upon arrival to the land of the Indigenous people, the settler colonizer has incurred travel costs, T, where $T \in (0, \infty)$, and chooses the level of preemptive violence, denoted by $\lambda \in [1, \infty)$, to enact against them. In addition to physical violence, this variable is composed of other documented methods of coercion[9] enacted against Indigenous peoples such as threats and strategically disruptive settlement to prevent access to food and spread disease (for more details see Kades (2000) and Dunbar-Ortiz (2014a)). If the settler colonizer intends to take the land for themselves, then their level of preemptive violence[10] falls anywhere between passive disruption (e.g., $\lambda = 1$) and the most explicitly violent expression of expropriation of the Indigenous people group's land that they are capable of (e.g., $\lambda \to \infty$). The Indigenous people then chooses the level of resistance, $R \in [0, \infty)$, to mount in response to the violence.

We consider that the settler offers compensation, $M \in [0, \infty)$, to the Indigenous people

this unified settler-colonizing coalition is composed of many actors pursuing a common goal, we assign the coalition "they/them" pronouns. This understanding of a collusive project rather than just a government is important for our analysis as it emphasizes the structural nature of settler colonialism.

[9]Settler-colonial violence both includes physical violence and is also more than that. Dunbar-Ortiz (2014b, p. 8) explains, "Settler colonialism, as an institution or system, requires violence or the threat of violence to attain its goals...In employing the force necessary to accomplish its goals, a colonizing regime institutionalizes violence."

[10]We extend upon the work done by Anderson and Mc Chesney (1994) by considering that settlers can choose from a continuum of violence, rather than a binary choice of "raid or trade." We refrain from characterizing settler-colonial violence as a dichotomous variable to align with the consensus that it would be an oversimplification that erases meaningful aspects of the interactions between the settler-colonial state and Indigenous peoples (Rider, 1993; Kades, 2000; Banner, 2007).

group from whom they wish to take the land.[11] Finally, the Indigenous people group chooses to either accept or reject the compensation offer, M, in light of the initial levels of settler-colonial violence,[12] λ. If the Indigenous people accepts the offer, then the land is exchanged and the game ends. At this point, the Indigenous people no longer receives the benefit, denoted by B, of living with the land[13] from which they are now removed, where $B \in (0, \infty)$.[14] Meanwhile, the settler colonizer receives the monetary value V where $V \in (0, \infty)$. If the Indigenous people rejects the offer, then the interaction immediately escalates to all-out conflict, or war, over the land between the two groups.[15]

If the Indigenous people rejects the compensation offer and the interaction escalates to all-out conflict, then the probability that the settler colonizer succeeds in forced removal of the Indigenous people from their land is p; correspondingly, the probability that they lose in all-out conflict over the land is $1 - p$, where $p \in [0, 1]$. Beyond the likelihood of succeeding in explicit forced removal of the Indigenous people, we include several other parameters that influence the Indigenous people group's decision to accept or reject the settler colonizer's offer. For instance, γ represents the economic dependence of the Indigenous people on

[11] Primarily, the US held monopsonistic power to purchase Indigenous lands. This was generally true across two dimensions; namely, the US through "Johnson v. M'intosh" and preemption, successfully precluded individual settlers and European powers, respectively, from presenting competing offers for Indigenous lands. See Wolfe (2006) and Kades (2000) for more detailed discussions. Note that this game similarly assumes that a single Indigenous people group was the sole seller, or monopoly, for the land in consideration. Thus, as suggested by Kades (2000), the game is reduced to a bilateral monopoly.

[12] To reflect the documented fact that the mere presence of settlers was harmful to Indigenous peoples, the only way that the settler colonizer can avoid causing harm in this game is if they leave before trespassing upon the land and make no compensation offer, M and λ are completely removed; if they were to do this, then the game ends and the settler colonizer has for their payoffs only accrued the cost of traveling, T.

[13] We use the word "with" to honor that for Indigenous peoples land is more than a resource to be exploited (see, for example, Rowe and Tuck (2017)). We acknowledge that we are all in relation with the land, though for some (e.g., the settler colonizer) that relationship is restricted "to the relationship of the owner to his property" (Tuck and Yang, 2012).

[14] By creating this parameter for the Indigenous people group, we again aim to draw attention to the distinction between the settler colonial view of land as something to be exploited for profit and Indigenous peoples' relationships with the land. Namely, that settlers viewed land as real estate and Indigenous people view land as sacred (Dunbar-Ortiz, 2014a, p. 54).

[15] The levels of violence and resistance associated with the actual attempted explicitly forced removal of the Indigenous people (strategic choices during an all-out conflict between the two groups) are outside the scope of our paper. The focus in our paper are the actions immediately preceding the negotiation that could collapse into such an event.

the settler society; it reflects how much the Indigenous people values settler compensation, where $\gamma \in [0, 1]$. If the Indigenous people considers settler compensation to be completely without value, then $\gamma = 0$. Conversely, if they are wholly economically dependent on settler institutions, then $\gamma = 1$. In addition, c_S and c_I represent the marginal costs of engaging in violence and resistance for the settler and Indigenous people, respectively. In addition to it being costly for the settler colonizer to be violent, it becomes more costly when the Indigenous people group resists their violence. Another important parameter that we include is that which accounts for the intrinsic ability of the Indigenous people group to resist, β, where $\beta \in (0, \infty)$ and will for the remainder of the analysis be referred to as resilience.[16] Relatedly, the settler has an innate ability to inflict harm, denoted by D where $D \in (0, \infty)$, which acts as a multiplier to the settler colonizer's preemptive violence (for the remainder of this analysis, we refer to this as violence effectiveness).

The payoff for the Indigenous people group, if they lose their land and accept the settler colonizer's compensation, is expressed as follows

$$\pi_I^{accept} = \gamma M - H(\lambda, R) - C_I(R). \tag{1}$$

The first term represents the effective value of settler compensation, the second term is the harm they endure, and the third term is the cost of resisting settler violence. The harm borne by the Indigenous people group is specified as

$$H(\lambda, R) = \frac{D}{\beta} \times \frac{\lambda}{R}. \tag{2}$$

Note that the harm function is increasing in the level of the harmful actions taken by the

[16] We include this parameter to capture factors that make an Indigenous people more or less able to resist settler-colonial violence. Among many others, these include factors such as how reliant an Indigenous people is on game for sustenance, their degree of reliance upon Indigenous trade roots, which were commonly seized by settlers (for more details see Dunbar-Ortiz (2014a, p. 41)), the structure of their society, fighting tactics, ability to maintain alliances with other Indigenous nations, and geographical attributes.

settler colonizer, $H_\lambda > 0$, and settler violence effectiveness, $H_D > 0$. [17] In addition, the harm to the Indigenous people group is decreasing in their resilience, $H_\beta < 0$ and their chosen level of resistance, $H_R < 0$. The cost function for the Indigenous people is

$$C_I(R) = \frac{c_I}{\beta} \times R, \tag{3}$$

which is increasing in the level of Indigenous resistance and decreasing in resilience. If instead the Indigenous people group rejects the settler colonizer's offer, then the Indigenous people's expected payoff is given by

$$\pi_I^{reject} = p[-H(\lambda, R) - C_I(R)] + [1-p][B - H(\lambda, R) - C_I(R)]. \tag{4}$$

Equation 4 represents the expected payoff that the Indigenous people receives if they reject the settler's compensation offer. The settler's payoff, if their offer is accepted, is

$$\pi_S^{accept} = V - M - C_S(\lambda, R), \tag{5}$$

which represents the valuation of the land by the settler, less compensation and costs.[18] If instead the Indigenous people group rejects the settler colonizer's compensation offer, then their expected payoff is

$$\pi_S^{reject} = p[V - C_S(\lambda, R)] + [1-p][-C_S(\lambda, R)], \tag{6}$$

where the first term is the probability that the settler prevails in all-out conflict over the land multiplied by the valuation of the land less the costs of their attempt to seize it. The

[17] Where H_x denotes the first derivative of the harm function with respect to x.

[18] Note that the settler colonizer does not internalize the consequences of their actions for Indigenous peoples, as Kades (2000) discusses, "Instead of facilitating free trade that would have maximized the joint product of both societies, European settlers adopted rules that maximized their own utility, regardless of Indian welfare."

second term is the product of the probability that the settler loses in war over the land and the costs they face. Specifically, they face the following costs

$$C_S(\lambda, R) = c_S \times \left(\frac{\lambda}{D} + \beta \times R^2 \right) - T. \tag{7}$$

Note that it is costly for the settler colonizer to harm the Indigenous people group and their total costs are also increasing in effective Indigenous resistance. As a reminder, the last term is a fixed travel cost.

In summary, the structure of the game is as follows: (1) the settler colonizer chooses how much to harm the Indigenous people group, λ, then (2) the Indigenous people group chooses how much to resist, R, that violence. Next, (3) the settler determines how much to offer for compensation, M, and then (4) the Indigenous people group chooses to accept or reject the offer. If they accept, then the exchange occurs. If they reject, then the two groups engage in all-out conflict over the land. Finally, we incorporate a structural power imbalance by allowing for the probability that the settler colonizer succeeds in open conflict over the land to be affected by the settler colonizer's preemptive violence level; [19] that is, $p \equiv 1 - \frac{1}{\lambda}$. Recall from the previous discussion that this violence, λ, is a composite term in the sense that it is made up of all of the documented ways that settler colonizers diminish Indigenous peoples' ability to engage in truly voluntary exchange. Consequently, if settler violence leading up to the offer of compensation is extremely high, $\lambda \to \infty$, then the probability that the settler wins in outright conflict over the land is one. We next obtain the equilibrium results using backward induction.

[19] Skaperdas (1992) also uses the win probability to reflect agents' respective power. The simplification we maintain for this analysis is that only the settler-colonial regime may directly influence the probability of winning in all-out conflict. We include the structural power imbalance to incorporate the discussions in, for example, Anderson and Mc Chesney (1994) and Banner (2007); they discuss that the settler colonial power possessed certain structural advantages in comparison to Indigenous peoples. We do so in this less specific way in lieu of further complicating the model.

Stage 4: The Indigenous people accepts or rejects settler compensation.

We begin by analyzing the circumstances under which the Indigenous people group accepts the settler's compensation offer and forfeits their land.

LEMMA 1. *The Indigenous people accepts the settler colonizer's offer if and only if:*

$$M \geq \frac{B}{\gamma\lambda}. \tag{8}$$

With consideration for the above inequality, it is important to note that an offer, M, inducing acceptance must be greater if the benefit of the land to the Indigenous people is higher. It can be lower, however, if the Indigenous people group values the settler colonizer's currency more (e.g., the economic dependence parameter, γ, is higher), or if the violence, λ, enacted by the settler increases (all other variables held constant in each respective scenario). This relationship, taken in conjunction with the fact that settler payoffs are strictly decreasing in M, lends additional insight into why the settler strategically increases initial violence, λ, even when they seek to avoid direct seizure of Indigenous land; namely, they are violent to reduce the value of the offer that an Indigenous people would be willing to accept.

Stage 3: The settler colonizer offers compensation.

The settler colonizer must determine whether it is optimal to induce acceptance, and will do so if and only if the following holds:

$$\pi_S^{accept} \geq \pi_S^{reject}. \tag{9}$$

That is, the condition that the settler's profits must be greater under acceptance than under rejection must hold to motivate the settler colonizer to provide an acceptance-inducing offer, which we discuss below.

LEMMA 2. *The settler colonizer will induce acceptance if and only if:*

$$V \geq \frac{B}{\gamma}. \tag{10}$$

This condition implies that it is more difficult (a higher settler valuation of the land is required) for the settler to make an acceptable offer if the Indigenous people is deeply connected to the land (e.g., higher value for B). Similarly, it is more difficult for the settler to justify inducing acceptance if the Indigenous people is less dependent upon settler compensation (e.g., γ is lower when the Indigenous people is less dependent upon the settler's economic system).

Stage 2: The Indigenous people chooses a resistance level.

Upon experiencing the violence enacted by the settler colonizer, the Indigenous people chooses a resistance level.

LEMMA 3. *The Indigenous people's best-response function is:*

$$R(\lambda) = \left(\frac{D}{c_I} \times \lambda\right)^{\frac{1}{2}}. \tag{11}$$

Intuitively, the Indigenous people's best-response resistance is increasing in the effective harm they endure and decreasing in their cost of resisting. In addition, regardless of whether the settler colonizer induces acceptance or rejection, the Indigenous people maintains the same best-response function. Next, we examine the first stage of the game in which the settler chooses a level of violence.

Stage 1: The settler colonizer chooses a violence level.

Internalizing the aforementioned conditions and best-response resistance, the settler colonizer determines the optimal level of violence to engage in. The following are the results of

the interaction.

PROPOSITION 1. *The equilibrium actions taken by the settler colonizer and Indigenous people group are:*

(i) under acceptance

$$\hat{\lambda}^* = \left[\frac{BDc_I}{c_S\gamma(c_I + D^2\beta)}\right]^{\frac{1}{2}},\ \hat{R}^* = \left[\frac{BD^3}{c_I c_S\gamma(c_I + D^2\beta)}\right]^{\frac{1}{4}},\ \textit{and}\ \hat{M}^* = \left[\frac{Bc_S(c_I + D^2\beta)}{\gamma Dc_I}\right]^{\frac{1}{2}}$$

(ii) under rejection

$$\overline{\lambda}^* = \left[\frac{VDc_I}{c_S(c_I + D^2\beta)}\right]^{\frac{1}{2}},\ \overline{R}^* = \left[\frac{VD^3}{c_S c_I(c_I + D^2\beta)}\right]^{\frac{1}{4}},\ \overline{M}^* = 0.$$

We discuss a number of insights drawn from these results in the remainder of our analysis, but consider first that these results reflect that regardless of whether the settler induces an exchange or all-out conflict, there are always positive levels of violence in equilibrium. The strategic benefit that the settler colonizer obtains when they harm the Indigenous people before making the offer comes from two avenues: (1) as shown in Lemma 1, the Indigenous people is willing to accept a lower compensation when they are confronted with higher settler violence before the offer is made and (2) their preemptive violence conveys a higher probability of success to the settler in the event that the Indigenous people rejects and the interaction escalates to all-out conflict. That is, settler violence makes it cheaper to acquire the land by compensation and conveys more favorable odds if they engage in all-out conflict. The structural advantages that the settler enjoys in this game inherently contribute to the widespread use of violence against the Indigenous people.

For comparison, we make several simplifications to the general structure of the game to outline a benchmark game wherein it is impossible for the settler to extort the Indigenous people. Specifically, we remove the capacity for the settler colonizer to harm the Indigenous

people (Stage 1) and the ability of the Indigenous people to resist (Stage 2); the settler colonizer can only offer compensation, M, for the land and must allow the Indigenous people group to freely choose to accept or reject the offer. It is valuable for interpretation of the main game to understand what the exchange may look like under the aforementioned structurally different circumstances. The conclusions of this benchmark game are presented in the following corollary.

COROLLARY 1. *If we remove the possibility of violence and resistance, then the settler will offer the acceptable compensation level, $M^* = \frac{B}{\gamma}$, to the Indigenous people if and only if $V \geq \frac{B}{\gamma}$.*

Therefore, the settler only makes an offer in this benchmark game if its valuation, V, of the land is greater than the benefit received by the Indigenous people group for that land, B, divided by the weight, γ, that the Indigenous people assigns to the settler's compensation offer, M. The more the Indigenous people is economically dependent upon the settler-colonizer's compensation, the lower the valuation that the settler needs in order to justify making an acceptable offer. Conversely, if the land is more important to the Indigenous people, the settler's valuation of the land must be higher for it to be worthwhile for the settler to make an acceptable compensation offer. The next naturally arising question we address is whether the Indigenous people is compensated more under acceptance in the game without coercion.

LEMMA 4. *The Indigenous people is compensated weakly more without coercion ($M^* \geq \hat{M}^*$) if and only if*

$$B \geq \frac{\gamma c_S(c_I + D^2\beta)}{Dc_I}.$$

Note that, all else held constant in each case, if the cost of settler violence increases or the Indigenous people is more economically dependent upon settler compensation, it is more difficult for the above condition to be satisfied. Either of these would imply it would be easier

for it to be true that the Indigenous people group is compensated more when coercion is present. Whereas, if the Indigenous people experiences greater benefit from the land, which can also be understood to being more integrally attached to it, the condition indicating that compensation is greater in the scenario without coercion is more easily satisfied. This aligns with the relationship in Lemma 1 that demonstrates violence is a tool that the settler can employ to reduce the acceptable offer amount. Similarly, if the Indigenous people faces higher costs of resistance, the condition is satisfied more easily. This implies that if it is more costly to resist violence, then it would be more easily true that an Indigenous people receives higher compensation when coercion is not allowed. Next, we return to the complete model and examine its corresponding comparative statics.

2.1 Comparative Statics

Below we examine the comparative statics associated with the equilibrium levels of settler violence, Indigenous resistance, and acceptable compensation.

LEMMA 5. *The equilibrium levels of violence and resistance (under acceptance and rejection), and acceptable compensation respond in the following ways:*

(i) the settler colonizer's violence increases (decreases) in the cost of resistance for the Indigenous people group and, if $D < \sqrt{\frac{c_I}{\beta}}$*, in violence effectiveness (cost of violence for the settler colonizer, Indigenous resilience, and economic dependence, respectively);*

(ii) Indigenous resistance decreases in the cost of resistance, the settler colonizer's cost of violence, Indigenous resilience, and economic dependence, but increases in violence effectiveness;

(iii) compensation increases (decreases) in the cost of violence and Indigenous resilience

(cost of resistance, economic dependence, and if $D < \sqrt{\frac{c_I}{\beta}}$, settler violence effectiveness, respectively).

In Table 1, we summarize the results described in Lemma 5. The comparative statics for

Table 1: Comparative Statics

	Settler Violence	Indigenous Resistance	Acceptable Compensation
Marginal Cost of Indigenous Resistance, c_I	+	-	-
Marginal Cost of Settler Violence, c_S	-	-	+
Indigenous Resilience, β	-	-	+
Violence Effectiveness, D	$+^*$	+	$-^*$
Economic Dependence, γ	-	-	-

* if $D < \sqrt{\frac{c_I}{\beta}}$

settler violence and Indigenous resistance hold if the settler induces acceptance or rejection (regardless of which equilibrium prevails). In addition, the results for compensation only pertain to acceptance given that if the settler wishes to induce rejection they offer no compensation. In order to connect our findings to documented events, we provide Table 2, which contains a sample of the examples included in our discussion that follows.

Table 2: Connections to Comparative Statics

Comparative Statics	Examples
Settler Violence Increasing in the Marginal Cost of Indigenous Resistance	Sand Creek Massacre
Resistance Decreasing in the Marginal Cost of Indigenous Resistance	Sand Creek Massacre, The Seminole Nation
Indigenous Resistance is Decreasing in Indigenous Resilience	Iroquois Confederacy and the Continental Army
Settler Violence Decreasing in the Marginal Cost of Violence	James Carleton's treatment of Navajo

We next discuss the comparative statics for which we include examples in Table 2 in the order that they appear in the table. Therefore, we begin with the finding indicating

that settler violence is increasing in the marginal cost of resistance. A horrific example[20] of extreme unprovoked violence being exacted upon Indigenous peoples who had already endured sustained violence and could no longer resist enough (e.g., increased marginal cost of resistance), given the conditions that they were subjected to, is the Sand Creek Massacre. Dunbar-Ortiz (2014a, p. 137) explains that:

> [D]isplaced and captive Cheyennes and Arapahos...incarcerated in a US military reservation called Sand Creek...camped under a white flag of truce...[were] on November 29, 1864...[w]ithout provocation or warning...attacked [by seven hundred Colorado Volunteers], leaving dead 105 women and children and 28 men.

The circumstances that the Cheyenne and Arapaho peoples were subjected to not only harmed them, but also forced them into a uniquely bad situation for defending themselves. The marginal cost of resistance is very high, for example, in the face of hunger and exhaustion. They were isolated, not prepared for attack, and their group consisted of mostly women and children. The Sand Creek Massacre highlights the dangerous equilibrium effects of an increase in the marginal cost of Indigenous resistance. In this circumstance, an increased marginal cost of resistance was related with settler violence escalating and Indigenous resistance diminishing to a devastating level.

In addition to providing insight into the circumstances that made the Sand Creek Massacre so devastating, the comparative static indicating that an Indigenous people's resistance is decreasing in the marginal cost of resisting could also lend insight to Indigenous peoples who have historically resisted settlement more successfully. An example of such a people is the Seminole Nation,[21] that, as described by Dunbar-Ortiz (2014a, pp. 101–102), "was born of resistance...never sued for peace, were never conquered...never signed a treaty with the

[20]Despite the fact that the specific examples provided throughout our paper are not exact replicas of the central model we consider, they are indicative of the structural objective of the settler-colonial regime, which does correspond generally with the model. That is, these historical examples fit within a structural game that the settler-colonial regime is playing with Indigenous peoples wherein the objective is to acquire land at the lowest cost possible.

[21]The Seminole Nation in the US, contained both self-liberated Africans and survivors of previously destroyed Indigenous communities.

United States, and...never ceased to exist in the Everglades." Their resistance is especially distinctive given that the US waged three wars against the Seminole Nation, the second of which, "was the longest foreign war waged by the United States up to the Vietnam War" (Dunbar-Ortiz, 2014a, p. 101). Part of their relative success is attributed to the guerrilla tactics they employed that increased their effectiveness at resisting (e.g., decreased marginal cost of resisting) settler violence (for more details see Dunbar-Ortiz (2014a, p. 101)). That is, perhaps they were able to provide relatively more resistance given their increased effectiveness at resisting settlers.

Another result contained in Lemma 5 is that resistance is decreasing in the Indigenous people's resilience; that is, as their resilience increases, the optimal level of resistance decreases given that they would need less to achieve the same goals. This is not to say that they do not resist, but rather that the less vulnerable they are, the lower levels of additional resistance they need to engage in to limit harm. An example demonstrating the importance of including resilience in the model is the stark difference in the resistance success between the Cherokee Nation and the Haudenosaunee (Six Nations Iroquois) surrounding the time of the Revolutionary War. In this example, unity seems to be a primary contributor to resilience. The British and separatist settlers sought alliances with these Indigenous nations to aid in their own conflicts. Dunbar-Ortiz (2014a, p. 74) describes, "Despite constant attacks on its villages and crops, and with refugees and disease, the enormous Cherokee Nation remained intact with a well-functioning government." Settlers' extreme violence and cruelty, "caused them to be despised and spurred some Cherokees to take sides against them...separatists quickly announced their determination to destroy the Cherokee Nation." Despite settlers' total war campaign against the Cherokee Nation, they were unsuccessful in removing them from their land until close to 50 years after the US won their independence (Dunbar-Ortiz, 2014a, p. 76). In contrast, the Haudenosaunee were split in the alliances they forged (some forged alliances with the British, some remained neutral, and one made an alliance with the

settlers), and so, "With the Iroquois confederacy disunited regarding the war, the Continental Army forces were practically unimpeded in their triumphal and deadly march...[and] civil war erupted within the Iroquois Confederacy itself" (Dunbar-Ortiz, 2014a, p. 77).

Our result that the equilibrium level of settler violence is decreasing in the marginal cost of enacting the violence is reflected in the following scenario. Dunbar-Ortiz (2014a, pp. 138–139) describes the acts of then US Army brigadier general James Carleton, who:

> With unlimited authority and answering to no one...spent the entire Civil War in the Southwest engaged [leading the Colorado Volunteers] in a series of search-and-destroy missions against the Navajos...and in 1864 in a three-hundred mile forced march of eight thousand Navajo civilians to a military concentration camp...At least a fourth of the incarcerated died of starvation. Not until 1868 were the Navajos released and allowed to return to their homeland...This permission was not based on the deadly conditions of the camp, rather that Congress determined that the incarceration was too expensive to maintain.

In contrast to the Sand Creek Massacre, where violence increased to its most extreme expression and did not abate, in this example the very high violence levels were lowered and so a complete massacre was avoided; this eventual reduction, despite the devastatingly weakened state of the Navajos who had endured the march and incarceration, occurred explicitly because the settler regime determined that those additional levels of violence were too costly (e.g., increased marginal cost of violence).

Now we provide additional examples for the results observed in Lemma 5. Though they are not included in Table 2 specifically, there are connections that we can draw to those examples and that we can understand more intuitively. For instance, the comparative static indicating that resistance is decreasing in the marginal cost of settler violence. In a sense, equilibrium resistance is more necessary if the costs to the settlers of enacting violence are relatively low, which is demonstrated by the example above. This, along with the comparative static that indicates settler violence is decreasing in the cost of enacting violence, reflects the necessity that Indigenous peoples faced when confronted with a settler colonizer that found it relatively cheap to be violent.

Resistance is similarly decreasing in economic dependence upon settler institutions; this implies that if the Indigenous people necessarily values settler compensation relatively more, then they will lower their resistance levels. This could lend some insight into the strategic benefit of a favored settler-colonial practice of disrupting game patterns and Indigenous trade routes, as Dunbar-Ortiz (2014a, p. 41) summarizes anthropologist Henry Dobyns, "the ensuing acute shortages, including food products, weakened populations and forced them into dependency on the colonizers, with European manufactured goods replacing Indigenous ones." In the context of this analysis, these behaviors directly reduce the compensation that the settler state must offer Indigenous peoples.

In regard to the changes in optimal acceptable compensation, we find that it increases in the cost of violence and decreases in the cost of resistance. Therefore, the need for Indigenous resistance is integrally related to both their harm reduction and reception of better compensation in exchanges. The comparative statics also indicate that the optimal levels of violence, resistance, and compensation when the settler colonizer induces acceptance are all increasing in the benefit that the Indigenous people group receives from living with the land. If the settler colonizer induces rejection, then the optimal values of violence and resistance are both increasing in the settler valuation of the land. In the following section, we extend the model to allow for cost-reducing activism on behalf of an Indigenous people.

3 Application to Activism Today

As settler colonialism is a persisting structure, aspects of the game central to this analysis are immensely relevant to some of the challenges that Indigenous peoples' face in the US, and North America, today. In this section, we extend the sequential-move game with coercion to consider activist support. The extension is valuable because it inherently considers that settler-colonialism persists today and examines whether activism can help to reduce

harm for Indigenous peoples. Whyte (2017) situates settler colonialism as an intricate social process that manifests in part as environmental injustice. This supports the relevance of this extension for, as an example, the conflicts related to the location and construction of pipelines in North America (e.g., the Dakota Access and Keystone XL pipelines), in which activists have attempted to aid in Indigenous peoples' resistance efforts (Mazer, 2017). The only deviation in the model from that of the game with coercion is that activism, $\alpha \in [1, \infty)$, can reduce the cost of resisting for the Indigenous people. Note that if $\alpha = 1$ then activists are not helpful at all. The Indigenous people's cost function is therefore:

$$\widetilde{C_I}(R) = \frac{c_I}{\alpha\beta} \times R \tag{12}$$

Stages 4 and 3 lead to the same conditions as they did in the previous section without activism, so we will next only discuss Stages 2 and 1, respectively.

Stage 2: The Indigenous people group chooses a resistance level.

Upon experiencing the violence enacted by the settler colonizer, the Indigenous people resists. However, in this version of the game the Indigenous people receives aid in the form of activism.

LEMMA 6. *The Indigenous people group's best-response function is:*

$$R(\lambda) = \left(\frac{\alpha D}{c_I} \times \lambda\right)^{\frac{1}{2}}. \tag{13}$$

As before, the Indigenous people's best-response resistance is increasing in the initial violence they endure and decreasing in their cost of resisting. However, resistance is also increasing in the level of cost-reducing activism. That is, greater levels of cost-reducing activism permits greater levels of resistance.

Stage 1: The settler colonizer chooses a violence level.

The settler chooses the optimal level of violence to engage in. In the following proposition, we present the results of this modified game.

PROPOSITION 2. *With activism, the equilibrium actions taken by the settler colonizer and Indigenous people group are:*

(i) under acceptance

$$\lambda_A^* = \left[\frac{BDc_I}{c_S\gamma(c_I + D^2\alpha\beta)}\right]^{\frac{1}{2}},\ R_A^* = \left[\frac{\alpha^2 BD^3}{c_I c_S\gamma(c_I + D^2\alpha\beta)}\right]^{\frac{1}{4}},\ \textit{and}\ M_A^* = \left[\frac{Bc_S(c_I + D^2\alpha\beta)}{\gamma Dc_I}\right]^{\frac{1}{2}}$$

(ii) under rejection

$$\lambda_R^* = \left[\frac{VDc_I}{c_S(c_I + D^2\alpha\beta)}\right]^{\frac{1}{2}},\ R_R^* = \left[\frac{\alpha^2 VD^3}{c_S c_I(c_I + D^2\alpha\beta)}\right]^{\frac{1}{4}},\ M_R^* = 0.$$

We next examine whether activism helps to reduce equilibrium violence.

LEMMA 7. *The equilibrium settler violence level in the model that allows for cost-reducing activism on behalf of the Indigenous people is lower than in the model where it is absent for all admissible parameter values.*

Before we formally examine the consequences of this result for the monetary compensation offered to the Indigenous people under acceptance, as we will at a later point in this section, we can intuit the consequences. Namely, because we observe that settler violence lowers the acceptable compensation level (see Lemma 1), and we see here that cost-reducing activism leads to lower levels of violence, we would expect activism to also increase the level of compensation that the Indigenous people receives. For now, we focus on discussing the direct effect of activism on violence.

That activism unambiguously reduces the violence that Indigenous peoples endure has relevance for land-use conflicts today, especially those related to infrastructure projects such

as oil pipelines. Montoya (2016) and Spice (2018) discuss that the US and Canada's framing of oil pipelines as necessary for national security, as critical infrastructures, allow for some peaceful protests against their construction to be interpreted as domestic terrorism, which can in turn lead to state-sanctioned violence against protesters. This violence aids in private companies' efforts to exploit unceded Indigenous lands, but Indigenous resistance often forces these projects to be suspended (Spice, 2018). An illustrative example is the widely known conflict at Standing Rock regarding the Dakota Access Pipeline (DAPL). The DAPL was rerouted, in response to water contamination concerns for an area of predominately white residents, further south to cross the Missouri River upstream of the Standing Rock Sioux Reservation. Despite this project violating the Fort Laramie Treaties of 1851 and 1868, the change was accepted and project approved in July 2016 by the Army Corps of Engineers without approval of the Standing Rock Sioux Tribe (Archambault II, 2016; Mazer, 2017). Resistance (calling themselves "water protectors"), comprised of allies such as environmentalists and more than ninety Indigenous nations by August 2016, to the DAPL grew as the project construction reached unceded treaty lands on the grounds of, among other concerns, protecting water and sacred spaces for the tribe (Mazer, 2017). By November 2016, the water protectors had faced so much police violence[22] that two thousand US military veterans announced they would go to protect them (Levin, 2017; Mazer, 2017; Mele, 2016). The veterans declared their intent to serve as a "human shield" for the water protectors, and the day after thousands of veterans arrived to the protest camp, "the Army Corps of Engineers announced that it had denied easement for the pipeline...[until it could issue] an environmental impact statement" (Tolan, 2016). So, for at least a small window of time, the pressure was alleviated by activism.

Here we formally examine how activism affects compensation levels. Namely, we are concerned with whether the addition of activism increases or reduces compensation.

[22] "The authorities have used rubber bullets, pepper spray and water cannons against demonstrators, hundreds of whom have been injured, according to protest organizers" (Mele, 2016).

LEMMA 8. *For all admissible parameter values, compensation is higher in the game with activism than when it is absent.*

Therefore, not only does activism reduce equilibrium violence and increase resistance, it does in fact increase the compensation that Indigenous peoples receive in these settings. Next, we consider the comparative statics when activism is included.

3.1 Comparative Statics

In this section, we examine comparative statics of the equilibrium levels of settler violence, Indigenous resistance, and acceptable compensation in the game where cost-reducing activism is now included.

LEMMA 9. *The equilibrium levels of violence and resistance (under acceptance and rejection) and compensation respond in the following ways to activism*[23] *:*

(i) the settler colonizer's violence decreases in activism;

(ii) Indigenous resistance increases in activism;

(iii) compensation increases in activism.

The direction of all of the comparative statics included in the previous section are maintained in this section. However, the inclusion of cost-reducing activism contributes additional comparative statics and points of discussion.[24] The first of these is that settler violence is

[23]Note that the direction of the other comparative statics are the same as those in Lemma 5 and can be found in the Proof of Lemma 9.

[24]In addition to the added comparative statics, it makes the condition that determines whether settler violence increases in, and compensation decreases in, settler violence effectiveness more difficult to satisfy. That is, it lowers the settler violence effectiveness threshold needed for the settler to switch from increasing their violence and decreasing compensation to decreasing their violence and increasing compensation, respectively.

decreasing in activism. Further, resistance and compensation are both increasing in activism. Therefore, in this theoretical setting, cost-reducing activism unambiguously benefits Indigenous peoples.

Returning to the example of the DAPL protests, the unification of the Standing Rock Sioux Tribe with environmentalists, veterans, and other Indigenous nations, bolstered the levels of resistance they were able to mount, and led to delays in construction. The increased resistance as a result of activism corresponds with Lemma 9.

4 Conclusion

In this paper, we consider a context characterized by a structural power imbalance and the violence of settler colonialism. We do so by developing a model that directly addresses a central component of settler colonialism, the strategic dispossession of Indigenous peoples of their land so that the settler society can establish itself. We consider that the settler-colonial methods of appropriation involved coercion, rather than applying a framework where free exchange or all-out conflict are the only possible equilibria. By allowing for coercion in the interaction between an Indigenous people and settler-colonial regime, we critically examine whether authentic consent is possible in exchanges where these dynamics are maintained. We further extend the model to allow for activism. In doing so, we gain insights into the strategic interactions central to both the founding of the US settler-colonial state and to ongoing exchanges between Indigenous peoples and the US settler-colonial state.

We find that the settler-colonial coalition uses violence before exchanges with Indigenous peoples to appropriate their land at a lower cost. Additionally, we demonstrate that cost-reducing activism on behalf of Indigenous peoples can both bolster Indigenous resistance and result in reductions to equilibrium settler violence. Lastly, we find that effective cost-reducing activism increases the compensation an Indigenous people can receive even in the

context of a structural power imbalance.

There are a number of extensions of our paper that can continue characterizing the interactions between Indigenous peoples and settlers. For example, it could be beneficial to consider a setting in which Indigenous peoples have a better understanding of the land than the settler (information asymmetries) or a context in which these two groups engage in several rounds of negotiation (repeated-game setting). Understanding these historical interactions helps to identify an inequitable negotiation process that Indigenous peoples still endure. This critical analysis, in conjunction with others, can help to alert economists and other policy shapers to the manifestations and consequences of settler colonialism. From this awareness, acknowledgement of and healing changes to systems and policies in the US can grow.

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A Appendix

A.1 Proof of Lemma 1

The Indigenous people group chooses to accept the settler colonizer's offer if the value of accepting the offer is greater than the expected value of rejecting the offer and allowing negotiations to break down. That is, they accept the offer, M, if and only if $\pi_I^{accept} \geq \pi_I^{reject}$. This implies:

$$\gamma M - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R \geq (1-p)\left(B - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R\right) + p\left(-\frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R\right). \tag{14}$$

Upon rearranging (and substituting in the equation for p), it follows that:

$$\gamma M - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R \geq \left(1 - 1 + \frac{1}{\lambda}\right) B - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R. \tag{15}$$

which yields

$$M \geq \frac{B}{\gamma\lambda}. \tag{16}$$

A.2 Proof of Lemma 2

The settler colonizer induces acceptance if

$$\pi_S^{accept} \geq \pi_S^{reject}, \tag{17}$$

which implies

$$V - M - c_S \times \left(\frac{\lambda}{D} + \beta \times R^2\right) - T \geq pV - c_S \times \left(\frac{\lambda}{D} + \beta \times R^2\right) - T. \tag{18}$$

Rearranging and substituting in the expression for acceptable M and p, it follows that:

$$V \geq \frac{B}{\gamma}. \tag{19}$$

A.3 Proof of Lemma 3

The Indigenous people group chooses how much to resist, R, the settler colonizer's preemptive violence, λ. There are two cases to consider.

Case 1: Acceptance

If $V \geq \gamma^{-1}B$, and so acceptance is induced ($M = \frac{B}{\gamma\lambda}$), it implies that the Indigenous people faces this scenario:

$$\max_R \left[\gamma \times \frac{B}{\gamma\lambda} - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R\right] \tag{20}$$

Simplifying, it becomes:

$$\max_R \left[\frac{B}{\lambda} - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R\right] \tag{21}$$

Finding the first-order condition with respect to R yields

$$\frac{\partial \pi_I^{accept}}{\partial R} = \frac{D\lambda}{\beta R^2} - \frac{c_I}{\beta} = 0, \tag{22}$$

and solving for R we obtain

$$R(\lambda) = \sqrt{\frac{D}{c_I} \times \lambda}. \tag{23}$$

Case 2: Rejection

If $V < \gamma^{-1}B$, and so rejection is induced ($M = 0$), the Indigenous people is confronted with this choice:

$$\max_R \left[(1-p)B - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R\right] \tag{24}$$

Upon substitution and simplification, it becomes:

$$\max_{R} \left[\frac{B}{\lambda} - \frac{D\lambda}{\beta R} - \frac{c_I}{\beta} \times R \right] \tag{25}$$

Finding the first-order condition with respect to R yields

$$\frac{\partial \pi_I^{reject}}{\partial R} = \frac{D\lambda}{\beta R^2} - \frac{c_I}{\beta} = 0, \tag{26}$$

and solving for R we obtain:

$$R(\lambda) = \sqrt{\frac{D}{c_I} \times \lambda}. \tag{27}$$

Therefore, regardless of the scenario (when either acceptance or rejection is induced), the Indigenous people group maintains the same best response.

A.4 Proof of Proposition 1

The settler colonizer chooses the level of preemptive violence to enact against the Indigenous people group, internalizing their resistance best-response functions. There are two cases to consider.

Case 1: Acceptance

If $V \geq \gamma^{-1}B$), then the settler colonizer solves the following maximization problem:

$$\max_{\lambda} \left[V - M - c_S \times \left(\frac{\lambda}{D} + \beta \times R(\lambda)^2 \right) - T \right]. \tag{28}$$

Recall that in this scenario the settler sets $M = \frac{B}{\gamma\lambda}$ (see Lemma 1), which implies:

$$\max_{\lambda} \left[V - \frac{B}{\gamma\lambda} - c_S \times \left(\frac{\lambda}{D} + \beta \times R(\lambda)^2 \right) - T \right]. \tag{29}$$

Substituting in the Indigenous people group's best-response function for R (see Lemma 3) further implies:

$$\max_{\lambda}\left[V-\frac{B}{\gamma\lambda}-c_S\times\left(\frac{\lambda}{D}+\beta\times\left[\sqrt{\frac{D}{c_I}\times\lambda}\right]^2\right)-T\right]. \tag{30}$$

Simplifying the above expression yields

$$\max_{\lambda}\left[V-\frac{B}{\gamma\lambda}-c_S\lambda\left(\frac{1}{D}+\frac{D\beta}{c_I}\right)-T\right], \tag{31}$$

and finding the first-order condition with respect to λ we obtain

$$\frac{\partial\pi_S^{accept}}{\partial\lambda}=\frac{B}{\gamma\lambda^2}-c_S\left(\frac{1}{D}+\frac{D\beta}{c_I}\right)=0. \tag{32}$$

Solving for λ, we obtain

$$\hat{\lambda}^*=\left[\frac{BDc_I}{c_S\gamma(c_I+D^2\beta)}\right]^{\frac{1}{2}}. \tag{33}$$

Substituting in the profit-maximizing violence level chosen by the settler colonizer into the Indigenous people's best-response function and acceptable compensation level, respectively, yields

$$\hat{R}^*=\left(\frac{D}{c_I}\times\sqrt{\frac{BDc_I}{c_S\gamma(c_I+D^2\beta)}}\right)^{\frac{1}{2}}. \tag{34}$$

Simplification of the above implies:

$$\hat{R}^*=\left[\frac{BD^3}{c_Ic_S\gamma(c_I+D^2\beta)}\right]^{\frac{1}{4}}. \tag{35}$$

Now recall that:

$$\hat{M}^*=\frac{B}{\gamma}\times(\hat{\lambda}^*)^{-1}. \tag{36}$$

Substituting in the expression for $\hat{\lambda}^*$ results in the following:

$$\hat{M}^* = \frac{B}{\gamma} \times \left(\sqrt{\frac{BDc_I}{c_S\gamma(c_I + D^2\beta)}} \right)^{-1}. \tag{37}$$

Which in turn yields

$$\hat{M}^* = \left[\frac{Bc_S(c_I + D^2\beta)}{\gamma D c_I} \right]^{\frac{1}{2}}. \tag{38}$$

Case 2: Rejection

If $V < \gamma^{-1}B$, then the settler colonizer solves the following maximization problem:

$$\max_{\lambda} \left[pV - c_S \times \left(\frac{\lambda}{D} + \beta \times R(\lambda)^2 \right) - T \right]. \tag{39}$$

Substituting in the Indigenous people group's best response function implies:

$$\max_{\lambda} \left[\left(1 - \frac{1}{\lambda} \right) V - c_S \times \left(\frac{\lambda}{D} + \beta \left[\sqrt{\frac{D}{c_I} \times \lambda} \right]^2 \right) - T \right]. \tag{40}$$

Upon rearranging, it follows that

$$\max_{\lambda} \left[\left(1 - \frac{1}{\lambda} \right) V - c_S\lambda \times \left(\frac{1}{D} + \frac{\beta D}{c_I} \right) - T \right]. \tag{41}$$

For which the first-order condition with respect to λ is

$$\frac{\partial \pi_S^{reject}}{\partial \lambda} = \frac{V}{\lambda^2} - c_S \times \left(\frac{1}{D} + \frac{\beta D}{c_I} \right) = 0. \tag{42}$$

Solving for λ, we obtain

$$\overline{\lambda}^* = \left[\frac{VDc_I}{c_S(c_I + D^2\beta)} \right]^{\frac{1}{2}}. \tag{43}$$

Substituting the profit-maximizing violence level chosen by the settler colonizer, when they induce rejection, into the Indigenous people's best-response function to determine their op-

timal level of resistance yields

$$\overline{R}^* = \left(\frac{D}{c_I} \times \sqrt{\frac{VDc_I}{c_S(c_I + D^2\beta)}} \right)^{\frac{1}{2}} \tag{44}$$

Simplifying the above expression results in

$$\overline{R}^* = \left[\frac{VD^3}{c_S c_I (c_I + D^2\beta)} \right]^{\frac{1}{4}} \tag{45}$$

A.5 Proof of Lemma 4

The Indigenous people is compensated weakly more without coercion ($M^* \geq \hat{M}^*$) if and only if:

$$\frac{B}{\gamma} \geq \sqrt{\frac{Bc_S(c_I + D^2\beta)}{\gamma Dc_I}} \tag{46}$$

Which further implies that

$$\left[\frac{B}{\gamma} \right]^2 \geq \left[\sqrt{\frac{Bc_S(c_I + D^2\beta)}{\gamma Dc_I}} \right]^2, \tag{47}$$

which yields

$$\frac{B}{\gamma} \geq \frac{c_S(c_I + D^2\beta)}{Dc_I}. \tag{48}$$

Solving for B implies

$$B \geq \frac{\gamma c_S(c_I + D^2\beta)}{Dc_I}. \tag{49}$$

Additionally, note that the condition is more easily satisfied if the cost of resisting increases for the Indigenous people because

$$\frac{\partial}{\partial c_I} \left(\frac{\gamma c_S[c_I + D^2\beta]}{Dc_I} \right) = -\frac{Dc_S\beta\gamma}{c_I^2}. \tag{50}$$

A.6 Proof of Lemma 5

The expressions for the comparative statics are below. As there were before, there are two cases to consider.

Case 1: Acceptance ($V \geq \gamma^{-1}B$)

The derivative of $\hat{\lambda}^*$ with respect to the cost of violence is negative by assumption since

$$\frac{\partial \hat{\lambda}^*}{\partial c_S} = -\frac{1}{2}\left(\frac{BDc_I}{c_S^3\gamma[c_I + D^2\beta]}\right)^{\frac{1}{2}} < 0. \tag{51}$$

The derivative of $\hat{\lambda}^*$ with respect to the cost of resistance is positive by assumption since

$$\frac{\partial \hat{\lambda}^*}{\partial c_I} = \frac{1}{2}\left(\frac{BD^5\beta^2}{c_I c_S\gamma[c_I + D^2\beta]^3}\right)^{\frac{1}{2}} > 0. \tag{52}$$

The derivative of $\hat{\lambda}^*$, violence under acceptance, with respect to β is negative by assumption since

$$\frac{\partial \hat{\lambda}^*}{\partial \beta} = -\frac{1}{2}\left(\frac{BD^5c_I}{c_S\gamma[c_I + D^2\beta]^3}\right)^{\frac{1}{2}} < 0. \tag{53}$$

The derivative of $\hat{\lambda}^*$ with respect to violence effectiveness is positive

$$\frac{\partial \hat{\lambda}^*}{\partial D} = \frac{1}{2}\left(\frac{Bc_I}{Dc_S\gamma[c_I + D^2\beta]^3}\right)^{\frac{1}{2}} \times \left(c_I - D^2\beta\right) > 0 \tag{54}$$

if $c_I > D^2\beta$ or $D < \sqrt{\frac{c_I}{\beta}}$.

The derivative of $\hat{\lambda}^*$ with respect to γ is negative by assumption since

$$\frac{\partial \hat{\lambda}^*}{\partial \gamma} = -\frac{1}{2}\left(\frac{BDc_I}{c_S\gamma^3[c_I + D^2\beta]}\right)^{\frac{1}{2}} < 0. \tag{55}$$

The derivative of $\hat{R}^*$ with respect to the cost of settler violence is negative by assumption

since

$$\frac{\partial \hat{R}^*}{\partial c_S} = -\frac{1}{4}\left(\frac{BD^3}{c_S^5 c_I \gamma[c_I + D^2\beta]}\right)^{\frac{1}{4}} < 0. \tag{56}$$

The derivative of $\hat{R}^*$ with respect to the cost of resisting is negative by assumption since

$$\frac{\partial \hat{R}^*}{\partial c_I} = -\frac{2c_I + D^2\beta}{4}\left(\frac{BD^3}{c_S c_I^5 \gamma[c_I + D^2\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{57}$$

The derivative of $\hat{R}^*$ with respect to β is negative by assumption since

$$\frac{\partial \hat{R}^*}{\partial \beta} = -\frac{1}{4}\left(\frac{BD^{11}}{c_S c_I \gamma[c_I + D^2\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{58}$$

The derivative of $\hat{R}^*$ with respect to violence effectiveness is positive by assumption since

$$\frac{\partial \hat{R}^*}{\partial D} = \frac{1}{4}\left(\frac{3c_I + D^2\beta}{D[c_I + D^2\beta]}\right) \times \left(\frac{BD^3}{c_I c_S \gamma[c_I + D^2\beta]}\right)^{\frac{1}{4}} > 0. \tag{59}$$

The derivative of $\hat{R}^*$ with respect to γ is negative by assumption since

$$\frac{\partial \hat{R}^*}{\partial \gamma} = -\frac{1}{4}\left(\frac{BD^3}{c_S c_I \gamma^5[c_I + D^2\beta]}\right)^{\frac{1}{4}} < 0. \tag{60}$$

The derivative of $\hat{M}^*$ with respect to the cost of settler violence is below positive by assumption since

$$\frac{\partial \hat{M}^*}{\partial c_S} = \frac{1}{2}\left(\frac{B[c_I + D^2\beta]}{c_I c_S \gamma D}\right)^{\frac{1}{2}} > 0. \tag{61}$$

The derivative of $\hat{M}^*$ with respect to the cost of Indigenous resistance is negative by assumption given that

$$\frac{\partial \hat{M}^*}{\partial c_I} = -\frac{1}{2}\left(\frac{D^3 B c_S \beta^2}{\gamma c_I^3[c_I + D^2\beta]}\right)^{\frac{1}{2}} < 0. \tag{62}$$

The derivative of $\hat{M}^*$, acceptable compensation, with respect to β is positive by assumption

since

$$\frac{\partial \hat{M}^*}{\partial \beta} = \frac{1}{2}\left(\frac{Bc_S D^3}{\gamma c_I[c_I + D^2\beta]}\right)^{\frac{1}{2}} > 0. \tag{63}$$

The derivative of $\hat{M}^*$ with respect to settler violence effectiveness is negative

$$\frac{\partial \hat{M}^*}{\partial D} = -\frac{1}{2}\left(\frac{Bc_S}{\gamma c_I D^3[c_I + D^2\beta]}\right)^{\frac{1}{2}} \times (c_I - D^2\beta) < 0 \tag{64}$$

if $c_I > D^2\beta$ or $D < \sqrt{\frac{c_I}{\beta}}$.

The derivative of $\hat{M}^*$ with respect to γ is negative by assumption since

$$\frac{\partial \hat{M}^*}{\partial \gamma} = -\frac{1}{2}\left(\frac{Bc_S[c_I + D^2\beta]}{\gamma^3 c_I D}\right)^{\frac{1}{2}} < 0. \tag{65}$$

Case 2: Rejection ($V < \gamma^{-1}B$)

The derivative of $\overline{\lambda}^*$, with respect to the cost of violence is negative by assumption given

$$\frac{\partial \overline{\lambda}^*}{\partial c_S} = -\frac{1}{2}\left(\frac{VDc_I}{c_S^3[c_I + D^2\beta]}\right)^{\frac{1}{2}} < 0. \tag{66}$$

The derivative of $\overline{\lambda}^*$ with respect to the cost of resistance is positive by assumption since

$$\frac{\partial \overline{\lambda}^*}{\partial c_I} = \frac{1}{2}\left(\frac{VD^5\beta^2}{c_S c_I[c_I + D^2\beta]^3}\right)^{\frac{1}{2}} > 0. \tag{67}$$

The derivative of $\overline{\lambda}^*$ with respect to β is negative by assumption since

$$\frac{\partial \overline{\lambda}^*}{\partial \beta} = -\frac{1}{2}\left(\frac{VD^5 c_I}{c_S[c_I + D^2\beta]^3}\right)^{\frac{1}{2}} < 0. \tag{68}$$

The derivative of $\overline{\lambda}^*$ given a change in settler violence effectiveness is positive

$$\frac{\partial \overline{\lambda}^*}{\partial D} = \frac{1}{2}\left(\frac{Vc_I}{Dc_S[c_I + D^2\beta]^3}\right)^{\frac{1}{2}} \times \left(c_I - D^2\beta\right) > 0 \tag{69}$$

if $c_I > D^2\beta$ or $D < \sqrt{\frac{c_I}{\beta}}$.

The derivative of $\overline{R}^*$ with respect to the cost of settler violence is negative by assumption since

$$\frac{\partial \overline{R}^*}{\partial c_S} = -\frac{1}{4}\left(\frac{VD^3}{c_S^5 c_I[c_I + D^2\beta]}\right)^{\frac{1}{4}} < 0 \tag{70}$$

The derivative of $\overline{R}^*$ with respect to the cost of resistance is negative by assumption since

$$\frac{\partial \overline{R}^*}{\partial c_I} = -\frac{2c_I + D^2\beta}{4}\left(\frac{VD^3}{c_S c_I^5[c_I + D^2\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{71}$$

The derivative of $\overline{R}^*$ with respect to β is negative by assumption since

$$\frac{\partial \overline{R}^*}{\partial \beta} = -\frac{1}{4}\left(\frac{VD^{11}}{c_S c_I[c_I + D^2\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{72}$$

The derivative of $\overline{R}^*$ with respect to settler violence effectiveness is positive by assumption since

$$\frac{\partial \overline{R}^*}{\partial D} = \frac{1}{4}\left(\frac{3c_I + D^2\beta}{D[c_I + D^2\beta]}\right) \times \left(\frac{VD^3}{c_I c_S[c_I + D^2\beta]}\right)^{\frac{1}{4}} > 0. \tag{73}$$

A.7 Proof of Lemma 6

First note that Stages 4 and 3 result in the same conclusions as those in Lemma 1 and Lemma 2. This is due to the fact that the new cost function is irrelevant to both of those stages. The following proof concerns Stages 2 and 1 of this modified game, wherein there are two cases under consideration. Note again the change in the costs that the Indigenous people group faces.

Case 1: Acceptance

If $V \geq \gamma^{-1}B$, and so acceptance is induced ($M = \frac{B}{\gamma\lambda}$), it implies that the Indigenous people faces this scenario:

$$\max_R \left[\gamma \times \frac{B}{\gamma\lambda} - \frac{D\lambda}{\beta R} - \frac{c_I R}{\alpha\beta}\right] \tag{74}$$

Simplifying, it becomes

$$\max_R \left[\frac{B}{\lambda} - \frac{D\lambda}{\beta R} - \frac{c_I R}{\alpha\beta}\right], \tag{75}$$

which yields

$$R(\lambda) = \sqrt{\frac{\alpha D}{c_I} \times \lambda}. \tag{76}$$

Case 2: Rejection

Whereas if $V < \gamma^{-1}B$, and so rejection is induced ($M = 0$), the Indigenous people is confronted with this choice:

$$\max_R \left[(1-p)B - \frac{D\lambda}{\beta R} - \frac{c_I R}{\alpha\beta}\right] \tag{77}$$

Upon substitution and simplification, it becomes:

$$\max_R \left[\frac{B}{\lambda} - \frac{D\lambda}{\beta R} - \frac{c_I R}{\alpha\beta}\right], \tag{78}$$

which also yields

$$R(\lambda) = \sqrt{\frac{\alpha D}{c_I} \times \lambda}. \tag{79}$$

Therefore, regardless of the scenario (when either acceptance or rejection is induced), the Indigenous people group maintains the same best-response function.

A.8 Proof of Proposition 2

The settler chooses the level of violence to enact against the Indigenous people group, internalizing their resistance best-response functions. Now, however, cost-reducing activism can occur.

Case 1: Acceptance

If conditions are such that it is optimal for the settler colonizer to induce acceptance (if $V \geq \gamma^{-1}B$), then the settler solves the following:

$$\max_{\lambda} \left[V - \frac{B}{\gamma\lambda} - c_S \times \left(\frac{\lambda}{D} + \beta \times R(\lambda)^2 \right) - T \right] \tag{80}$$

Substituting in the Indigenous people group's best-response function for R further implies:

$$\max_{\lambda} \left[V - \frac{B}{\gamma\lambda} - c_S \times \left(\frac{\lambda}{D} + \beta \times \left[\sqrt{\frac{\alpha D}{c_I} \times \lambda} \right]^2 \right) - T \right] \tag{81}$$

Simplifying,

$$\max_{\lambda} \left[V - \frac{B}{\gamma\lambda} - c_S\lambda \left(\frac{1}{D} + \frac{\alpha D\beta}{c_I} \right) - T \right], \tag{82}$$

which yields

$$\lambda_A^* = \left[\frac{BDc_I}{c_S\gamma(c_I + \alpha D^2\beta)} \right]^{\frac{1}{2}}. \tag{83}$$

Substituting the preemptive violence level into the Indigenous people's best-response function and acceptable compensation level, respectively, yields

$$R_A^* = \left[\frac{\alpha^2 BD^3}{c_I c_S \gamma(c_I + D^2\alpha\beta)} \right]^{\frac{1}{4}}. \tag{84}$$

Now recall that:

$$M_A^* = \frac{B}{\gamma} \times (\lambda_A^*)^{-1}. \tag{85}$$

Substituting in the expression for λ_A^* yields

$$M_A^* = \left[\frac{Bc_S(c_I + D^2\alpha\beta)}{\gamma D c_I}\right]^{\frac{1}{2}}. \tag{86}$$

Case 2: Rejection

If conditions are such that it is optimal for the settler to induce rejection (if $V < \gamma^{-1}B$), then the settler colonizer solves the following:

$$\max_{\lambda}\left[pV - c_S \times \left(\frac{\lambda}{D} + \beta \times R(\lambda)^2\right) - T\right] \tag{87}$$

Substituting in the Indigenous people group's best response function implies:

$$\max_{\lambda}\left[\left(1 - \frac{1}{\lambda}\right)V - c_S \times \left(\frac{\lambda}{D} + \beta\left[\sqrt{\frac{\alpha D}{c_I} \times \lambda}\right]^2\right) - T\right]. \tag{88}$$

Solving for λ, we obtain

$$\lambda_R^* = \left[\frac{VDc_I}{c_S(c_I + D^2\alpha\beta)}\right]^{\frac{1}{2}}. \tag{89}$$

Finally, substituting the profit-maximizing violence level chosen by the settler colonizer, into the Indigenous people's best-response function to determine their optimal level of resistance yields

$$R_R^* = \left[\frac{\alpha^2 V D^3}{c_S c_I(c_I + D^2\alpha\beta)}\right]^{\frac{1}{4}}. \tag{90}$$

A.9 Proof of Lemma 7

If equilibrium violence is higher without activism, it implies that it must be higher under both acceptance and rejection. Namely, it must be true that

$$\hat{\lambda}^* \geq \lambda_A^* \text{ and } \overline{\lambda}^* \geq \lambda_R^*. \tag{91}$$

Substituting the results from Propositions 2 and 3 into the above condition implies that

$$\sqrt{\frac{BDc_I}{c_S\gamma(c_I+D^2\beta)}} \geq \sqrt{\frac{BDc_I}{c_S\gamma(c_I+\alpha D^2\beta)}} \text{ and } \sqrt{\frac{VDc_I}{c_S(c_I+D^2\beta)}} \geq \sqrt{\frac{VDc_I}{c_S(c_I+D^2\alpha\beta)}} \tag{92}$$

which is true by assumption since $\alpha \geq 1$. Therefore, equilibrium violence is lower with the inclusion of cost-reducing activism.

A.10 Proof of Lemma 8

The Indigenous people is compensated more with the inclusion of activism ($M_A^* \geq \hat{M}^*$) if and only if:

$$\sqrt{\frac{Bc_S(c_I+D^2\alpha\beta)}{\gamma Dc_I}} \geq \sqrt{\frac{Bc_S(c_I+D^2\beta)}{\gamma Dc_I}}, \tag{93}$$

which is true by assumption since $\alpha \geq 1$.

A.11 Proof of Lemma 9

The expressions for the comparative statics are below. Note that there are two cases to consider.

Case 1: Acceptance

The derivative of λ_A^* with respect to the cost of violence is negative by assumption since

$$\frac{\partial\lambda_A^*}{\partial c_S} = -\frac{1}{2}\left(\frac{BDc_I}{c_S^3\gamma[c_I+D^2\alpha\beta]}\right)^{\frac{1}{2}} < 0. \tag{94}$$

The derivative of λ_A^* with respect to the cost of resistance is positive by assumption since

$$\frac{\partial\lambda_A^*}{\partial c_I} = \frac{1}{2}\left(\frac{BD^5(\alpha\beta)^2}{c_Ic_S\gamma[c_I+D^2\alpha\beta]^3}\right)^{\frac{1}{2}} > 0. \tag{95}$$

The derivative of λ_A^* with respect to α is negative by assumption since

$$\frac{\partial \lambda_A^*}{\partial \alpha} = -\frac{1}{2}\left(\frac{BD^5\beta^2 c_I}{c_S\gamma[c_I + D^2\alpha\beta]^3}\right)^{\frac{1}{2}} < 0. \tag{96}$$

The derivative of $\lambda_A^*$with respect to β is negative by assumption since

$$\frac{\partial \lambda_A^*}{\partial \beta} = -\frac{1}{2}\left(\frac{BD^5\alpha^2 c_I}{c_S\gamma[c_I + D^2\alpha\beta]^3}\right)^{\frac{1}{2}} < 0. \tag{97}$$

The derivative of λ_A^* with respect to settler violence effectiveness is positive

$$\frac{\partial \lambda_A^*}{\partial D} = \frac{1}{2}\left(\frac{Bc_I}{Dc_S\gamma[(c_I + D^2\alpha\beta)]^3}\right)^{\frac{1}{2}} \times \left(c_I - D^2\alpha\beta\right) > 0 \tag{98}$$

if $c_I > D^2\alpha\beta$ or $D < \sqrt{\frac{c_I}{\alpha\beta}}$.

The derivative of λ_A^* with respect to γ is negative by assumption since

$$\frac{\partial \lambda_A^*}{\partial \gamma} = -\frac{1}{2}\left(\frac{BDc_I}{c_S\gamma^3[c_I + D^2\alpha\beta]}\right)^{\frac{1}{2}} < 0. \tag{99}$$

The derivative of R_A^* with respect to the cost of settler violence is negative by assumption since

$$\frac{\partial R_A^*}{\partial c_S} = -\frac{1}{4}\left(\frac{\alpha^2 BD^3}{c_S^5 c_I\gamma[c_I + D^2\alpha\beta]}\right)^{\frac{1}{4}} < 0. \tag{100}$$

The derivative of R_A^* with respect to the cost of resisting is negative by assumption since

$$\frac{\partial R_A^*}{\partial c_I} = -\frac{2c_I + D^2\alpha\beta}{4}\left(\frac{\alpha^2 BD^3}{c_S c_I^5\gamma[c_I + D^2\alpha\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{101}$$

The derivative of R_A^* with respect to α is positive by assumption since

$$\frac{\partial R_A^*}{\partial \alpha} = \frac{2c_I + D^2\alpha\beta}{4}\left(\frac{BD^3}{\alpha^2 c_S c_I\gamma[c_I + D^2\alpha\beta]^5}\right)^{\frac{1}{4}} > 0. \tag{102}$$

The derivative of R_A^* with respect to β is negative by assumption since

$$\frac{\partial R_A^*}{\partial \beta} = -\frac{1}{4}\left(\frac{\alpha^6 B D^{11}}{c_S c_I \gamma [c_I + D^2\alpha\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{103}$$

The derivative of R_A^* with respect to settler violence effectiveness is positive by assumption since

$$\frac{\partial R_A^*}{\partial D} = \frac{1}{4}\left(\frac{3c_I + D^2\alpha\beta}{D[c_I + D^2\alpha\beta]}\right) \times \left(\frac{\alpha^2 B D^3}{c_I c_S \gamma [c_I + D^2\alpha\beta]}\right)^{\frac{1}{4}} > 0. \tag{104}$$

The derivative of R_A^* with respect to γ is negative by assumption since

$$\frac{\partial R_A^*}{\partial \gamma} = -\frac{1}{4}\left(\frac{\alpha^2 B D^3}{c_S c_I \gamma^5 [c_I + D^2\alpha\beta]}\right)^{\frac{1}{4}} < 0. \tag{105}$$

The derivative of M_A^* with respect to the cost of settler violence is below positive by assumption since

$$\frac{\partial M_A^*}{\partial c_S} = \frac{1}{2}\left(\frac{B[c_I + D^2\alpha\beta]}{c_I c_S \gamma D}\right)^{\frac{1}{2}} > 0. \tag{106}$$

The derivative of M_A^* with respect to the cost of Indigenous resistance is negative by assumption given that

$$\frac{\partial M_A^*}{\partial c_I} = -\left(\frac{D^3 B c_S (\alpha\beta)^2}{4\gamma c_I^3 [c_I + D^2\alpha\beta]}\right)^{\frac{1}{2}} < 0. \tag{107}$$

The derivative of M_A^* with respect to α is positive by assumption since

$$\frac{\partial M_A^*}{\partial \alpha} = \frac{1}{2}\left(\frac{B c_S \beta^2 D^3}{\gamma c_I [c_I + D^2\alpha\beta]}\right)^{\frac{1}{2}} > 0. \tag{108}$$

The derivative of M_A^* with respect to β is positive by assumption since

$$\frac{\partial M_A^*}{\partial \beta} = \frac{1}{2}\left(\frac{B c_S \alpha^2 D^3}{\gamma c_I [c_I + D^2\alpha\beta]}\right)^{\frac{1}{2}} > 0. \tag{109}$$

The derivative of M_A^* with respect to settler violence effectiveness is negative

$$\frac{\partial M_A^*}{\partial D} = -\frac{1}{2}\left(\frac{Bc_S}{\gamma c_I D^3[c_I + D^2\alpha\beta]}\right)^{\frac{1}{2}} \times (c_I - D^2\alpha\beta) < 0 \tag{110}$$

if $c_I > D^2\alpha\beta$ or $D < \sqrt{\frac{c_I}{\alpha\beta}}$.

The derivative of M_A^* with respect to γ is negative by assumption since

$$\frac{\partial M_A^*}{\partial \gamma} = -\frac{1}{2}\left(\frac{Bc_S[c_I + D^2\alpha\beta]}{\gamma^3 c_I D}\right)^{\frac{1}{2}} < 0. \tag{111}$$

For when $V < \gamma^{-1}B$, when the settler induces rejection:

Case 2: Rejection

The derivative of λ_R^* with respect to the cost of violence is negative by assumption given

$$\frac{\partial \lambda_R^*}{\partial c_S} = -\frac{1}{2}\left(\frac{VDc_I}{c_S^3[c_I + D^2\alpha\beta]}\right)^{\frac{1}{2}} < 0. \tag{112}$$

The derivative of λ_R^* with respect to the cost of resistance is positive by assumption since

$$\frac{\partial \lambda_R^*}{\partial c_I} = \frac{1}{2}\left(\frac{VD^5(\alpha\beta)^2}{c_S c_I[c_I + D^2\alpha\beta]^3}\right)^{\frac{1}{2}} > 0. \tag{113}$$

The derivative of λ_R^* with respect to α is negative by assumption since

$$\frac{\partial \lambda_R^*}{\partial \alpha} = -\frac{1}{2}\left(\frac{VD^5\beta^2 c_I}{c_S[c_I + D^2\alpha\beta]^3}\right)^{\frac{1}{2}} < 0. \tag{114}$$

The derivative of λ_R^* with respect to β is negative by assumption since

$$\frac{\partial \lambda_R^*}{\partial \beta} = -\frac{1}{2}\left(\frac{VD^5\alpha^2 c_I}{c_S[c_I + D^2\alpha\beta]^3}\right)^{\frac{1}{2}} < 0. \tag{115}$$

The derivative of λ_R^* given a change in settler violence effectiveness is positive

$$\frac{\partial \lambda_R^*}{\partial D} = \frac{1}{2}\left(\frac{Vc_I}{Dc_S[c_I + D^2\alpha\beta]^3}\right)^{\frac{1}{2}} \times \left(c_I - D^2\alpha\beta\right) > 0 \tag{116}$$

if $c_I > D^2\alpha\beta$ or $D < \sqrt{\frac{c_I}{\alpha\beta}}$.

The derivative of R_R^* with respect to the cost of settler violence is negative by assumption since

$$\frac{\partial R_R^*}{\partial c_S} = -\frac{1}{4}\left(\frac{\alpha^2 VD^3}{c_S^5 c_I[c_I + D^2\alpha\beta]}\right)^{\frac{1}{4}} < 0 \tag{117}$$

The derivative of R_R^* with respect to the cost of resistance is negative by assumption since

$$\frac{\partial R_R^*}{\partial c_I} = -\frac{2c_I + D^2\alpha\beta}{4}\left(\frac{\alpha^2 VD^3}{c_S c_I^5[c_I + D^2\alpha\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{118}$$

The derivative of R_R^* with respect to α is positive by assumption since

$$\frac{\partial R_R^*}{\partial \alpha} = \frac{2c_I + D^2\alpha\beta}{4}\left(\frac{VD^3}{\alpha^2 c_S c_I[c_I + D^2\alpha\beta]^5}\right)^{\frac{1}{4}} > 0. \tag{119}$$

The derivative of R_R^* with respect to β is negative by assumption since

$$\frac{\partial R_R^*}{\partial \beta} = -\frac{1}{4}\left(\frac{\alpha^6 VD^{11}}{c_S c_I[c_I + D^2\alpha\beta]^5}\right)^{\frac{1}{4}} < 0. \tag{120}$$

The derivative of R_R^* with respect to settler violence effectiveness is positive by assumption since

$$\frac{\partial R_R^*}{\partial D} = \frac{1}{4}\left(\frac{3c_I + D^2\alpha\beta}{D[c_I + D^2\alpha\beta]}\right) \times \left(\frac{\alpha^2 V D^3}{c_I c_S[c_I + D^2\alpha\beta]}\right)^{\frac{1}{4}} > 0. \tag{121}$$