



THE SCHOOL
OF PUBLIC POLICY

RESEARCH PAPER

Volume 15:31

November 2022

TO COERCE, OR NOT TO COERCE? ASSESSING POLICY STRATEGIES TO REGULATE SMALL- SCALE AND ARTISANAL MINING IN THE ANDES

Zaraí Toledo Orozco and Katherine McKiernan

TO COERCE, OR NOT TO COERCE? ASSESSING POLICY STRATEGIES TO REGULATE SMALL-SCALE AND ARTISANAL MINING IN THE ANDES

Zaraí Toledo Orozco and Katherine McKiernan

EXECUTIVE SUMMARY

Artisanal and small-scale mining (ASM), commonly informal, is a persistent problem in the Global South and Latin America in particular, as it creates environmental, health, labour and other societal issues, but governments need to realize that solely coercion against informal miners is a poor solution for regulating it.

ASM grew rapidly throughout the 2000s due to the commodity boom. While regulatory bodies have tried different strategies to legalize ASM, there is little research to indicate which strategy is more effective. This paper compares the regulatory strategies of Bolivia and Peru. Bolivia used co-operative strategies, using the input from the miners themselves to help inform their policies and enforcement. Peru used coercion to force the miners to comply with tough regulations and enforcement, and deter the expansion of the activity.

The paper argues that co-operation is more effective than coercion to regulate informal mining even though it comes at a cost. The key to effective policy is knowledge; a deep understanding of ASM comes from listening to the informal miners' input and crafting policy based on that understanding of the sector. In Peru, the policies did not factor in local conditions and thus were simply not feasible. Partnering with local actors who know the sector will lead to more informed regulations and opportunities for positive enforcement. Resorting to incentives rather than to punishment in turn leads to higher levels of compliance.

Coercion, on the other hand, may initially reduce the number of informal miners but enforcement is expensive and requires ongoing monitoring. Nor does it reduce the knowledge gap or institutional limitations, leading to regulations that are a poor fit and unlikely to be followed. It could even lead to miners dodging state control by turning to criminal organizations to fund their activities. Negative reinforcement will make the ASM regulatory situation worse, while positive reinforcement is more likely to gain the desired outcome.

However, there are downsides to co-operative strategies. Results accrue more slowly and rents will not see a radical increase. Moreover, co-operation can empower politically informal miners. Nevertheless, co-operative strategies are more effective in the long run to regulate the activity.

State strength is not the only factor in compliance. State-society relations are just as important. Co-operating with miners, creating long-term relationships and including their input means they have a stake in the process and are more likely to follow regulations to which they contributed. This is not to diminish the role of state strength in compliance, for it is necessary in conjunction with co-operation. The state needs a strong presence on the ground to enforce the regulations. Not only does this help with monitoring compliance and demonstrate the government's authority, it also shows the state's commitment to better resource governance.

ABSTRACT

Facing the rapid proliferation of artisanal and small-scale mining (ASM) in the 2000s, states with commodity-dependent economies pursued different strategies to regulate the activity. While some states have chosen to co-operate — that is, they have included informal miners in policy enforcement processes — others have chosen to coerce; that is, they have used heavy-handed policies against informal miners. This article assesses the effectiveness of these strategies in increasing compliance. We leverage a view of policy effectiveness that considers the type of state-society relations a policy fosters. We look at how different state-society relations impact the relevance a policy has to the subject it attempts to regulate. We argue that although imperfect, co-operation helps the state overcome its limitations on the knowledge of ASM and its limited institutional powers to enforce regulations alone. By learning about the activity in question and developing ties with the informal miners, the state can produce feasible regulation that is more likely to be followed. We build our theory using a parsimonious sequential game that highlights the relationship between the state and the informal miners. We illustrate the equilibrium by comparing the outcomes of the regulatory strategies pursued in Bolivia and Peru during the commodity boom of the 2000s.

INTRODUCTION

When we think about mining and social organizations, we often think about local communities resisting the impacts of large, multinational mining companies on their territories. Emblematic cases of defensive mobilization such as Tambogrande in Peru, Pascua Lama in Chile and Marmato in Colombia capture a longstanding preoccupation in the literature concerning how local communities have responded to large-scale mining projects. In contrast, authors have paid scant attention to the presence of artisanal and small-scale mining (ASM), the extractive activities that work with rudimentary or semi-mechanical technology. Just as with large-scale mining, there has been a radical increase in ASM since the commodity boom of the 2000s, with a labour force reaching more than 44 million people across 77 countries (The Artisanal and Small-scale Mining Knowledge Sharing Archive 2022). ASM, mostly led by rural communities, poses a significant challenge to resource-dependent economies where resource control is fundamental for state coffers. ASM activities are informal;¹ that is, they are not regulated by any state body, and they cause serious environmental, health and labour problems.

¹ We use the terms ASM and informal mining interchangeably. Unless specified otherwise, when talking about mining and miners we are always referring to ASM.

State strategies to implement regulation of ASM have varied widely. In South America, some, such as Bolivia, Guyana and, to a lesser extent, Brazil, have opted for co-operative strategies; they have chosen to include the input of informal miners in policy enforcement to increase compliance. Others, such as Peru, Colombia and Ecuador, are, to different degrees, implementing coercive strategies; they have chosen to rely on heavy-handed policies to increase compliance and they often aim to eradicate the activity. Yet, after 20 years of ASM expansion, we lack models and evidence to understand which policy strategies are most effective when addressing the challenges ASM creates. While many studies have identified problems in the field with state regulation (Poveda, Nogales and Calla 2015; SPDA 2015; Salo et al. 2016; Aranibal, Sandi and Lafuente 2017; Damonte 2018; Solidaridad 2020), further work is needed to scale up the assessments and understand the payoffs and overall outcomes of these strategies across similar states. To address this gap, we ask: In the battle between carrots and sticks, are coercive strategies proving to be more effective in increasing ASM's compliance with regulations?

We argue that even though co-operation forces the state to sacrifice policy autonomy to regulate miners, it ultimately increases the probability that informal miners will comply with regulations. Policy effectiveness does not only rely on the degree of unilateral strength that a state has and projects, but also on the type of state-society relations it fosters. Such relationships influence the relevance of a policy for the actors it tries to regulate and in turn, the degree of compliance to be observed. The two biggest challenges that states face when regulating ASM are the complexity of the activity and the limited institutional powers to enforce regulations. Strategies that foster state-society relations which address these challenges are more effective in the long run. Co-operation might not reduce informality right away, but in time it allows the state to gain detailed knowledge concerning ASM and develop ties with the miners. Knowledge and ties enable the state to produce feasible and relevant policies, which are more likely to be followed. Conversely, coercion may decrease the presence of informal miners in the short term, but it requires costly investments and ongoing monitoring of behaviour. It does not contribute to reducing the state's gaps in knowledge of ASM or to overcoming the state's institutional limitations. Instead, it may create incentives for informal miners to evade state control by affiliating with criminal groups that can fund their activities. This is true regardless of coercion's potential to signal state strength.

We illustrate why co-operation yields more effective policy outcomes in two countries least likely to comply — Bolivia and Peru. These Andean countries share similar histories and (low) state capacity, and they are highly dependent on mineral wealth. At the same time, they have an important ASM population that predates colonialism and wields meaningful organizational power. During the 2000s commodity boom, these countries proposed reforms to regulate ASM. We focus on the states' interaction with gold miners² because gold was the most profitable commodity during the boom; hence, regulatory efforts have centred on those working with gold.

Our study contributes to research on resource politics and policy by shedding light on an overlooked sector of ASM, articulating the debates around its regulation in South America

² Our assessment only considers the regulation of miners, those who extract the mineral independently (not as part of private or state companies). While the gold supply chain encompasses many other actors, we focus on the miners as they are the majority and have been the focus of the most recent attempts at regulation.

and providing a new perspective to assess the overall outcome of current state strategies. While our case studies are not perfect models, they provide significant evidence of the failures and successes of different policy programs when regulating miners. These cases illustrate when we are more likely to see tangible improvements in ASM regulation and what areas need further policy improvement. More broadly, our work has important implications for how developing states can increase compliance with new regulations through affordable, viable and democratic policy-making processes.

The paper puts forward a sequential model to explore the interactions between the state and the informal miners. Our model uses the state's ability to collect some tax revenue as a proxy for the state's effectiveness at regulating mining; that is, a state's power to enforce better practices in a sector that would otherwise act illegally. We combine the game theoretic model with fieldwork in our case studies. We conducted interviews in Bolivia and Peru with miners' associations, subnational officials, experts and members of the executive between 2013 and 2017, when mining reforms to regulate the sector took place. The paper proceeds as follows. First, we discuss why regulating ASM is such a challenging policy issue. Then, we present an approach to assess state strategies based on the relationships they foster with informal miners. Third, we develop a formal model showing how states and informal miners interact and how their relationship shapes the effectiveness of policy in regulating ASM. Through these case studies, we trace the mechanisms of our formal model and highlight how the miners' ability to respond to and challenge the state makes coercion a less effective strategy for regulating ASM. We conclude with policy recommendations emerging from our study.

CHALLENGES TO REGULATING ASM AND ASSESSMENT APPROACHES TO STATE STRATEGIES

ASM has always been a part of Latin American history. Since pre-colonial times, many Indigenous groups in the Amazon mined gold (Veiga 1997) and *campesinos* (peasants) alternated agriculture with mining (Pachas 2011). However, ASM has seen the largest expansion in times of economic and political crises. By the mid-1950s, many workers in Peru turned to informal mining as they fled repressive military governments (Sulmont 1980). In the 1980s, mine workers in Bolivia began to informally mine minerals when they lost their jobs at private and state mining companies following the implementation of neoliberal reforms (Dunkerley 1984). Most recently, the global demand for commodities pushed many unemployed workers in rural areas and others from nearby areas to work in ASM (Poveda, Cordova et al. 2015).³

The latest wave of ASM expansion in the 2000s led to serious environmental fallout. In the Peruvian Amazon, more than 18,000 hectares were lost to the activity in the last decade alone (The Artisanal Gold Council 2017). In Bolivia and Peru, ASM became the main source of mercury pollution, with deleterious effects on the health of local communities, increased deforestation and the contamination of rivers and fish (SPDA 2015). Moreover, ASM workers deal with terrible working conditions and in some mining camps, the lack of regulation led to the rise of exploitative regimes and an increase in violence (GIATOC 2016). The myriad

³ As we will explain in the case studies, ASM activities often take place in groups. In Bolivia, ASM is mostly organized in co-operatives, while in Peru ASM is organized in associations.

problems associated with ASM triggered activism and opposition in very different independent actors, such as environmentalist groups, foreign agencies and large-scale mining companies (Baraybar and Dargent 2020). Public pressure, combined with the rise of developmentalist states that sought to increase control over incoming mining revenues, resulted in mining-law reform. Wherever mining constituted a key economic activity in Latin America, laws were enacted or reformed to regulate ASM (Poveda, Cordova et al. 2015). The issue was particularly salient in the Andes where extractive activities constitute the main source of revenues and where ASM increased the most.

Yet, the regulation of ASM in the Andes faces several challenges. First, its great complexity impedes the development of one-size-fits-all policies and raises enforcement costs. Gold mining in particular varies in the type of deposits (alluvial, glacial, underground); the actors (landowners, tenants, miners, Indigenous, *campesinos*, foreigners) and the type of labour mass involved (seasonal, part-time, stable); the type of work done (extractor, peon, panner, mineral waste miner, service provider); and in the patterns of the miners' organizations (associations or co-operatives). Actors pursuing different types of labour in the gold mining supply chain face different degrees of vulnerabilities and payoffs as well. For example, while mineral extractors (those working in the mines) are exposed to greater safety risks, they are the ones with the lowest pay. Other actors such as mineral processors (those who separate the minerals from the rocks) face fewer risks and hazards and make considerably more profit.

Second, and closely related, institutional challenges hinder the states' capacities to enforce regulation of ASM. Frequently, states do not have an institutional presence in the areas where ASM proliferates and are not equipped to implement their own rules. Researchers have highlighted the production of a-contextual regulation in capital cities far from the rural areas that either cannot be effected or clashes with interests at the subnational level (Cremers, Kolen and de Theije 2013; Salo et al. 2016; Tubb 2020). To illustrate, in many cases the rules and legalization steps of ASM are costly, designed as if ASM were the same as large-scale mining companies and offering no immediate benefits. In other instances, regulation does not consider ASM's economic contribution and places greater restrictions on it which hurts other sectors of the local economy that depend on informal mining, such as commerce, transportation and agriculture.⁴ As a result, informal miners do not have incentives to change their practices or legalize their activities (Marshall and Veiga 2017).

Third, a group of authors has recently shed light on challenges emerging from the state-miners' relations which mediate the enforcement of regulations surrounding ASM. The degree of organization of the miners and their association with other groups (real or perceived) have shaped the state's approach towards ASM. Where the state has developed close ties with the miners, ASM's interests have been placed above those of other local actors and policy implementation tends to benefit them (Marston 2019). In other cases, where miners are perceived to be associated with criminal groups, coercive approaches have prevailed (Rettberg and Ortiz-Riomalo 2016; Baraybar and Dargent 2020). Subnationally, there is also evidence that alliances between local officials and informal miners have delayed the implementation of ASM regulation (Toledo Orozco 2022).

⁴ Many informal miners alternate between activities according to the season and reinvesting the profits from ASM. Evidence suggests that the money from gold mining is reinvested in local businesses such as restaurants and hardware stores or is sent out to other provinces to fund subsistence agriculture (Mosquera, Chavez, Pachas and Moschella 2009).

Mirroring these findings, current assessments of ASM regulation have focused on the first and second challenges. Authors and practitioners evaluate policies by looking at how well they tackle ASM's complexity; that is, if policies consider the difference in actors, mining deposits and labour regimes (IISD 2018; Solidaridad 2020). Others have looked at the institutional capacities that states have developed to expand their presence where ASM is present; that is, the investment or creation of specialized offices, regimes, bureaucracy or the display of forces of order (Cano 2021; OEA 2022; Alianza por la Minería Responsable 2022).

On the other hand, few have considered the third factor — the kind of state-society relations regulatory policies foster — and its impact on policy enforcement. Unilateral assessments focusing only on state strength omit the commodity boom's effect on societal actors. Actors such as informal miners working with commodities in great demand internationally were also empowered during this period of growth (Dargent, Feldmann and Luna 2017). Informal miners have developed an organizational power which allows them to support policies they see as useful or contest those perceived as adverse to their interests. Thus, we posit that a policy's effectiveness is relational; it is contingent on the response and type of interaction it generates with the subject the state is attempting to regulate.

We integrate the third challenge — the relationship between the state and informal miners — by accounting for the interaction between these two key actors. We argue that state-society relations impact the extent to which the regulated actors, in this case the miners, are willing to comply with new regulations. Strategies that foster state-society relations which help the state better overcome the main challenges for regulation — the complexity of ASM and the state's limited institutional enforcement capacities — are more effective in the long run.

To test this argument, we use a sequential model in which the state responds to the power of organization to which informal miners have committed themselves. We show how state responses do not occur in a vacuum; rather, they are a logical response to the potential resistance they expect to face from the informal miners. By allowing for the informal miners to respond to the state — and for the state to change its strategy — we are better able to uncover what type of enforcement strategy is more effective in the long term.

ASSESSING STATE STRATEGIES

States have responded to the challenges of forcing regulation on ASM by choosing between two main strategies — co-operation or coercion. Co-operation favours the inclusion of informal miners in policy implementation processes. To this end, the state recognizes ASM's role in the economy and society; it grants miners legal and political rights as a sector. There is specific legislation on the activity and institutional bodies to support and regulate it. Miners are brought to the bargaining table so they can give their input on enforcement policies. Moreover, they can foster their sectorial interests in politics.

Co-operation's biggest advantage is that it allows the state to maintain constant contact with a sector that would otherwise operate clandestinely. By increasing the interaction with ASM, the expectation is that the state can reduce information asymmetries and policy bottlenecks while identifying incentives to foster compliance. Under co-operative strategies, the state is unable to push forward immediate deadlines or signal its capacity

to control the activity. Instead, the miners are given a platform to help improve enforcement policies. On the other hand, co-operation can lead to the empowerment of informal miners, locally and nationally. Recognition and state support can contribute to positioning the activity as a local power; in other words, it could lead the state to lose control in mining towns. The state might appear less powerful when attempting co-operation because it is granting substantial influence to a societal group. In granting this influence, miners can increase their capacity to mobilize collectively to preserve their powers. Miners can also use state channels to prevent the implementation of higher standards of regulation, to lobby for exemptions and to obtain impunity.

Other states have favoured coercive strategies to enforce regulation and often deter the expansion of ASM. To this end, legislation and state institutions limit their role towards fostering the legalization of the activity via sanctions. The political participation of miners as a sector is limited or fully restricted and ASM activities tend to be labelled as “illegal” without distinguishing between different actors in the sector. Legislation is characterized by a large bureaucratic burden and restrictions for the development of ASM. Institutional bodies act as barriers to discourage the proliferation of the activity by establishing hard deadlines for legalization followed by a strong punitive component. The state backs up its approach with strong investments in coercive resources used to empower police and military raids in mining camps.

The biggest advantage of coercion is that it creates strong incentives for informal miners to follow regulations and legalize their practices. Through credible threats, the state expects to gain control over key mining areas while also creating in miners a sense of urgency to comply. Moreover, for politicians who need to show their ability to control informal groups to maintain their core constituencies, coercion signals a no-tolerance policy for unsanctioned activities. Thus, the state can increase its control over territories and show other citizens its ability to quickly address the new challenges. On the other hand, coercion is costly and requires the state’s constant presence and the mobilization of police and military resources to maintain a credible threat. Coercive strategies do not end after the initial push. One-time coercive activities will not lead to the complete legalization of miners. Instead, the state needs to maintain a minimal presence and keep organizing punitive operations to deter any re-emergence of ASM. Coercion can also force miners to avoid increased state regulation by fleeing state rule. This may foster the dispersion of miners towards new deposits and push them to develop ties with criminal groups that can help them continue ASM operations. While coercion sends an important signal of state power, it is by no means a perfect solution.

The state, therefore, is faced with two non-ideal options. On the surface, a state hoping to show its ability to control resources will favour coercion, precisely because coercion allows it to maintain control over the area, signal its strength and pressure miners to legalize their activities. However, we argue that coercion will yield suboptimal outcomes. While co-operation will not create a perfect solution — precisely because the miners will have the power to resist important regulatory reform — improving these state-society relations allows the state in the long run to enforce regulation more effectively than with coercion.

A FORMAL MODEL OF STATE-INFORMAL MINERS' RELATIONS

To illustrate the interaction with informal miners when the state looks to implement a regulatory strategy, we present a sequential model. This model has two actors: the state and the informal miners. While these are not the only actors who play a role in shaping the implementation of regulatory strategies, we simplify the model to focus on them for the sake of parsimony.⁵ The state's goal is to increase its ability to regulate ASM. On the one hand, the state hopes to force the informal miners to comply with certain regulatory standards and legalize their activities. On the other hand, the informal miners hope to maintain the status quo. They want to minimize regulation of their activity and loss of control to state interests. Thus, these two actors have clearly conflicting goals, making it difficult to find strategies that will work for everyone.

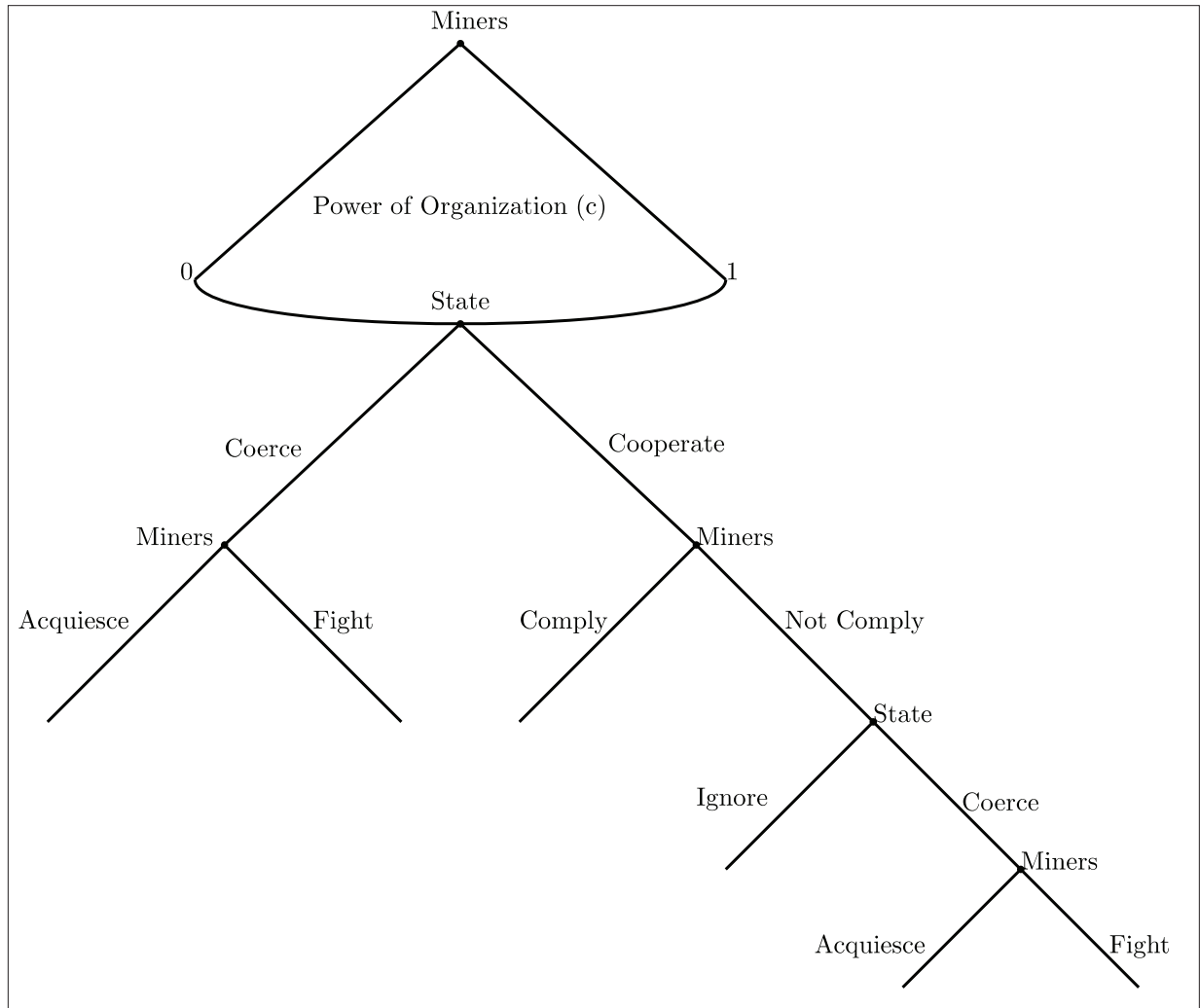
The model presented in Figure 1 proceeds as follows. First, the informal miners select their power of organization. This parameter represents the miners' capacity to resist regulation prior to the state's attempts at regulating ASM. Next, the state decides whether to respond to the challenges of ASM using co-operation or coercion.

If the state chooses to co-operate with informal miners, then the state works alongside the miners to improve the implementation of regulatory policies. The miners can then decide to comply with the legislation that they helped design, or to select non-compliance in the hopes of extracting further concessions from the state. If the informal miners comply, the game ends and the new legislation has been enforced. If, however, they choose not to comply, the state will decide whether to ignore the informal miners, reverting to the status quo prior to co-operation, or coerce them into compliance using credible threats. The miners can respond to coercion by acquiescing or by continuing to fight regulation.

Alternatively, if the state responds to the organized miners using coercion as the initial strategy, then the miners can choose whether to acquiesce to new legislation or fight to maintain the status quo. The game ends after the miners make their selection.

⁵ In the case studies, we elaborate on the complexity of the actual policy enforcement process.

Figure 1: Complete Sequential Model



The utility of the informal miners is a function of the size of the informal mining territory (m), the power of organization (c), the potential tax rate they will pay under state regulations (T) and the probability of success if the informal miners fight the state (p). The tax rate, T , is a proxy for the state's overall ability to control the mining territory since miners will have to accept the taxation expected in the formal economy as part of regulatory strategies. When the state chooses to co-operate, the miners will receive $m - Tm(1 - c) - c^2$ if they comply with legislation. This reflects a lower tax rate when miners have a larger power of organization. If the informal miners do not comply, the state decides whether to ignore the miners or use coercion. If the state ignores miners, then the miners will receive the utility m ; that is, the status quo prior to attempted regulation will reign. On the other hand, if the state coerces the informal miners, the miners must decide whether to acquiesce to the state's coercive strategy or fight. If the informal miners acquiesce to the state's coercive strategy, they receive $m - Tm - c^2$. By contrast, if the informal miners fight regulations, they will win with probability p and receive $m - c^2$ or they will lose with probability $(1-p)$ and receive the same payoff they would get had they acquiesced.

If the state's first move is coercion rather than co-operation, then the informal miners receive the same payoffs as if coercion were used in response to unsuccessful co-operation. Thus, if the miners acquiesce to regulations, they receive $m - Tm - c^2$. On other hand, if the miners choose to fight, they receive $m - c^2$ with probability p and $m - Tm - c^2$ with probability $(1-p)$.

The utility functions of the state are a function of the size of the mining territory (m), the potential tax rate (T), the probability that the informal miners who fight are successful (p) and the cost of coercing the informal miners (r). If the state initially decides to co-operate with the miners and the miners comply, the state receives the negotiated tax rate on miners, $T(1 - m) + Tm(1 - c)$. If the informal miners do not comply, the state can ignore them and tolerate the status quo minus the cost of effort they exerted in co-operation, $T - Tm - \epsilon$. Alternatively, they can change their strategy to coercion. If the state coerces the informal miners and the miners acquiesce, the state will achieve its desired tax rate and the utility is $T(1 - m) + Tm - r$, or, simply, $T - r$. If, on the contrary, the miners fight, then with probability p the state will lose and receive $T - Tm - r$ and with probability $(1-p)$ the state will win and receive $T - r$.

On the other hand, if the state initially uses coercion to enforce regulations, the state receives the same payoffs as if coercion were used in response to unsuccessful co-operation. It receives its desired tax rate if the miners acquiesce. If, on the contrary, the miners fight, the state receives its desired tax rate with probability $(1-p)$ and the status quo minus the cost of coercing the miners, $T - Tm - r$, with probability p .

Table 1 presents a summary of all variables and Table 2 presents a summary of utility functions.

Table 1: Variables and Potential Values

Variable	Definition	Range of Values
m	Share of mining territory controlled by informal miners	$m \in (0,1)$
c	Informal miners' power of organization	$c \in (0,1)$
T	Tax rate under state regulations	$T \in (0,1)$
p	Probability that informal miners succeed when fighting the state	$p \in (0,1)$
r	State's cost of coercing the informal miners	$r > 0$
ϵ	Cost of wasted effort if co-operation fails	$\epsilon > 0$

Table 2: Summary of Utility Functions for All Possible Actions

State Strategy	Informal Miners' Strategy	Utility of State	Utility of Informal Miners
Co-operate	Comply	$T(1 - m) + Tm(1 - c)$	$m - Tm(1 - c) - c^2$
Co-operate, Ignore	Not Comply	$T - Tm - \epsilon$	$m - c^2$
Co-operate, Coerce	Not Comply, Acquiesce	$T - r$	$m - Tm - c^2$
Co-operate, Coerce	Not Comply, Fight	$(1 - p)(T - r) + p(T - Tm - r)$	$p(m - c^2) + (1 - p)(m - Tm - c^2)$
Coerce	Acquiesce	$T - r$	$m - Tm - c^2$
Coerce	Fight	$(1 - p)(T - r) + p(T - Tm - r)$	$p(m - c^2) + (1 - p)(m - Tm - c^2)$

First, we consider what happens if the state's first move is to co-operate with the miners. We solve this model using backwards induction, and thus begin with the final selection: whether the informal miners will acquiesce or fight coercion.

Lemma 1: The informal miners will always fight if the probability of victory is greater than zero.⁶

In this scenario, the informal miners will always fight against coercion. This is important to understanding why coercion, though intuitively the most effective road to success, will always carry a risk for the state. Thus, if the state selects coercion, it will receive the utility $(1 - p)(T - r) + p(T - Tm - r)$.

Given that the informal miners will always fight against coercion, the state then decides whether to ignore informal miners who do not comply with co-operation or switch to coercion. The state will default to coercion whenever it has expended a large amount of effort on co-operating with the miners. Mathematically, this occurs when $\epsilon > r + Tm(p - 1)$. In other words, when the effort spent on co-operation is greater than the cost of repression plus the tax on mining times the probability the informal miners win minus one, the state will coerce. Given that $Tm(p - 1)$ is always negative, the state will likely turn to coercion albeit for many potential costs.

The informal miners, then, must choose between complying and accepting the co-operative agreement or not complying and facing coercion. The informal miners will comply whenever their power of organization, c , is greater than their probability of victory, p . In other words, because organized miners exert leverage during the design phase of informal mining regulations, they will be willing to comply with the regulations. The assumption that the power of organization is larger than the probability of victory is intuitive: more organized miners will have a greater probability of victory, but even miners who are strongly organized ($c=1$) will not have a guaranteed victory against a coercive state. Thus, we can assume that $c > p$ and that the miners will always comply with new regulations proposed by a co-operative state.

⁶ See the appendix for the complete model solution.

Next, we consider whether the informal miners will acquiesce or fight if the state's initial strategy is coercion. Per Lemma 1, the informal miners will always choose to fight, and a coercive state cannot guarantee that it will successfully coerce the informal miners to comply with regulations.

Finally, the state must decide whether to co-operate with the informal miners, knowing that they will comply (but that the state will lose a considerable amount of control over the law) or to coerce the informal miners and risk the miners successfully resisting regulation. The state will co-operate when the repression cost is $r > -Tm - ptm/c$. This is true except when repression is nearly costless. Thus, the state prefers co-operation, regardless of the miners' power of organization. The miners, therefore, will select the power of organization that maximizes their utility when the state co-operates, $Tm/2$.

This model has a unique equilibria solution: the miners select a power of organization $Tm/2$, comply when the state co-operates and fight when the state coerces. The state will co-operate with the miners and will coerce if they do not comply. This unique equilibrium leads us to a single optimal policy choice: The state is most likely to succeed in implementing mining regulations if it forgoes autonomous policy-making in favour of co-operating with the informal miners.

In the next section, we illustrate why this is the case, even if it represents a non-ideal outcome for both the state that wants autonomous control over mining regulations and the informal miners who desire the status quo. To do so, we explore the case of Bolivia where, in accordance with our equilibria solution, the state chose to co-operate with miners, and the case of Peru, where the state coerced them. The case studies allow us to address the complexity of implementing mining regulations that is not captured in the simplified model while also testing our argument.

CASE STUDIES

BOLIVIA

Gold mining in Bolivia is primarily concentrated in the regions of La Paz and Beni, both in the northern part of the country. Although the gold mining population has radically increased since the 2000s, miners inherited their power of organization from older copper and silver miners in southern Bolivia whose expansion dates from the 1980s. Gold miners, mainly those in La Paz, are organized in co-operatives and federations. Cooperatives vary in the number of *socios* (partners), which range from about 10 to 1,000 members (Poveda 2014). When the price of the mineral is low, co-operatives share the investment costs and the profits (if any). When the price goes up, they tend to hierarchize and act as small businesses; *socios* informally hire peons to do all the work. Co-operatives are organized in federations at the district, regional and national levels. Federations meet with the regional heads and make collective decisions regarding their activities and political matters. Federations are the miners' political arm and they mobilize, negotiate and advocate for the miners' interests. Gold miners constitute more than 80 per cent of the total size of the ASM population and, according to the main gold federations — the Federation of Auriferous Cooperatives of Northern La Paz (FECOMAN) and the Regional Federation of Auriferous of La Paz (FERRECO) — there are more than 2,000 gold co-operatives,

involving more than 150,000 families (Interview with FECOMAN and FERRECO leaders, La Paz, October 11, 2017). Other estimates say that the number triples when including peons (Marston 2019).

Since the 1980s, the Bolivian state has adopted a strategy of co-operation with miners. Mining cooperatives have a special fiscal regime⁷ and miners are allowed to participate in politics as a sector. They have won seats in the legislature and former mining co-operativists have been part of the executive branch. This participation has increased since Evo Morales won office in 2006 and the mining co-operativists were part of the ruling coalition. Yet, this has not meant that the relationship between the state and the miners was exempted from discrepancies and conflict. A case in point is the reform of the mining law.

After passing a new constitution aiming to increase the state's power over the economy and its national resources, in 2009 Morales' government began reforming the mining law. The draft law proposed a stronger role for the state in the allocation and administration of mining deposits, an increase in the taxation regime and more controls over the supply chain (Supreme Decree 29117). The state wanted to take advantage of the commodity boom which significantly contributed to the cooperatives' wealth. Until then, the cooperatives had paid certain duties to the treasury⁸ but their minimal contribution from royalties had not been modified. The reform also aimed to implement other types of regulation, such as environmental, normative and prior consultations — a procedure in which ethnic groups need to give or withhold their consent for any action impacting their lands. The miners quickly rejected the preliminary draft of the law because they wanted to participate in the drafting process (Okada 2016).

We, the miners, were not going to allow the discussion of the law behind our backs. We knew that if we had to go to the streets, as we did, we would do it ... and we were prepared (for) the answer of the government ... (Leader of the National Federation of Cooperatives, La Paz, October 18, 2017)

Two new drafts which had the miners' participation were issued in 2012 and 2013, but the miners contested them (Reuters 2012). Although the drafts proposed the creation of new state offices to support ASM, the miners opposed an increase in royalty contributions. They also pressed for the chance to contract with private companies (Okada 2016). This type of contract would have allowed the miners to export higher quantities of gold and private businesses to piggyback on the tax benefits of cooperatives.

At this point, several media outlets demanded that the state use a heavy hand to impose the rule of law (Página 2014a). Editorials disapproved of the relationship between the state and the miners and encouraged the executive to change strategy. Yet, once again, the state sat with the miners to work on a third draft in 2014. The new draft went through the legislature, which along with the Ministry of Mines pushed to implement more controls

⁷ Co-operatives have a special fiscal regime that exempts them from paying high taxes because in the 1980s, when Bolivia faced an economic crisis and mineral prices were low, they did not make a profit but only ensured the subsistence of the *socios* (Poveda 2014).

⁸ Mining cooperatives in Bolivia contribute an annual payment for the mining concession, for the volume and value of production and for the volume and value of exports. Though these are obligations commonly stipulated in countries with ASM, Bolivia is a unique case where miners comply with the law (Poveda, Nogales and Calla 2015).

over the activity, increase royalties and forbid contracting with private actors. The miners opposed this via street demonstrations. They blocked the streets in four regions to impede food delivery to urban areas, and in the midst of the conflict two miners died (El País 2014). In response, Morales stated:

I appeal to the consciousness and participation of the departmental leaders [from the mining co-operatives] to debate reasons and not whims so we can reach consensus and approve the new mining law. (Página Siete 2014b)

State representatives, cabinet members and the president himself sat down with the federation's leaders and decided to keep the regulation but postpone the royalty increase. In the end, the state was successful in persuading the miners to accept the new law. The outcome was not ideal for the miners, yet they settled for it. This is particularly puzzling given that the miners were highly organized, which would lead us to believe they could have continued their opposition. Why did they co-operate? In one miner's words:

It is better to have someone to talk, to negotiate with, even if it is a bad deal ...You always have tomorrow ...” (Leader of FECOMAN, La Paz, October 14, 2017)

By continuing to interact and negotiate with the government, the miners agreed to comply with the new legislation. At the same time, they were able to significantly influence the content of the law and consolidate a direct channel of communication with the executive. Their interests took precedence over those of other sectors, as the government negotiated only with them. On the contrary, argued the head of FECOMAN, “conflict could limit the possibilities of negotiation in the future” (interview cited in Okada 2016). In other words, miners prioritized being partners with the state. This was convenient as it allowed miners to argue for other benefits for their sector. For example, they were able to negotiate more credit channels via the Fund for Financing Mining (FOFIM), which is particularly useful when mineral prices go down. They negotiated training and more land deposits (Página Siete 2014c). They also pressed for a change in the distribution of revenues from ASM and an increase in the percentage that stays in their municipalities and nearby towns (Okada 2016), to benefit their communities.

The law's outcome was not ideal for the state either. Mainly, it lost the chance to significantly increase the royalties coming from ASM. Miners would only keep paying for certain duties such as the patents and 2.5 per cent from sales (Página Siete 2014c). Yet, co-operation was a better outcome than coercion, too. Beyond the political returns for the government, in the form of support for the governing party, co-operation offered tangible advantages for enforcing ASM regulations. First and foremost, violence and blockades were out of the picture, which prevented the rise in discontent among other sectors of society.

Second, by co-operating with the miners, the state could push for improvements in the sector. An institution in charge of the allocation, records and supervision of the mining deposits — the Mining Jurisdictional and Administrative Authority (AJAM in Spanish) — was created. AJAM also took charge of guiding the implementation of the prior consultation. The state could also push for the implementation of basic security measurements in the mines (helmets, lights, masks) and training, and miners committed to avoid working in protected areas (La Razón 2013). This is by far more than what informal miners do in all of Bolivia's neighbouring countries.

Third, the state was able to keep an account of the production and commercialization of minerals. Bolivia is one of the few countries in South America where the state has detailed records of the mining population and its production (La Razón 2013). Though the records rely mostly on self-declaration, which means they are not always transparent, the state has more information on the route of minerals, and gold in particular, than its neighbours.

PERU

Gold mining in Peru is present in 20 out of the country's 24 regions, though it is mainly concentrated in Madre de Dios, Puno, Ayacucho and Arequipa. Though not as great as that of their Bolivian counterparts, Peruvian gold miners have achieved an important organizational power. In the main gold regions, miners have formed associations, co-operatives and federations. Associations, which function as small businesses, can have up to 200 members (MINEM 2021). Federations such as the National Federation of Small Scale and Artisanal Mining Producers and (FENAMARPE) have a presence at the regional and national levels. There are more than 500,000 miners in Peru and more than 70 per cent of them work with gold (The Artisanal Gold Council 2017).

Since the mid-2000s, the Peruvian state has adopted a coercive strategy towards the miners. In 2010, then-president Alan Garcia passed legislation in which only legal, large-scale mining was treated as aligned with the state's economic and development interests. Under this framework, ASM not only lacked the state's support, but was also considered a harmful activity (Emergency Decree 12-2010). A year later, president Ollanta Humala tried to strengthen this framework by passing executive decrees and new legislation to regulate ASM.

The new legislation established rules to legalize ASM, ensure the activity could pay its royalties, develop a record of the mining population, eliminate its presence in vulnerable areas such as nature reserves and push for its compliance with safety and environmental standards (Supreme Decrees 013-2011; Legislative Decree 1102-2012). To this end, the state established a series of bureaucratic requirements for mining legalization and hard deadlines. At its core, the new legislation aimed to deter the expansion of the activity while also asserting the state's control over resources. For this reason, it supported the new norm with the use of force via raids and the justice system's participation via trials of informal miners operating without permits.

The state did not communicate with the miners while developing the regulations. In fact, informal miners are forbidden to participate in politics as a sector. The regulation at the time conflated actors in the ASM supply chain and labelled miners as illegal. Soon after the new regulation was made public, the miners declared that the legalization process was unfeasible:

As many of my fellows, we signed the "declaration of intention" [an official record of miners interested in legalizing their activities]. However, when we looked at the requirements, they were impossible! ... They were also very expensive ... We cannot pay as much as a big mining company ... they also wanted us to wait until the bureaucracy did its job so we could work. What was I going to feed up my family with? ... of course, we had to organize! (Interview, Madre de Dios, June 4, 2015)

After the first deadlines passed, only one per cent of the total mining population could go through the process of legalization (Defensoría del Pueblo 2014). New regional mining federations in the country, such as the Mining Federation of Madre de Dios (FEDEMIN) and the Federation of Small-scale and Artisanal Miners from Peru, gained substantial membership. To increase compliance, Humala's administration established new deadlines, passed executive decrees allowing more interdictions and granted the Ministry of the Interior more resources to enable its actions in mining camps (Andina 2013).

"I restate my decision to fight against illegal mining," Humala said. "All the rule of law will be weighted [against the miners] and interdictions will intensify." (President Ollanta Humala, speech, July 28, 2013)

As evidence of the coercive strategy's effectiveness, Humala's Ministry of the Interior showed a reduction in mining in key regions with high gold production (La Republica 2014). The law, however, contained features that made it unfeasible. For example, though it evolved to differentiate between informal mining, which does not have all the permits to operate, and illegal mining, which is forbidden in territories and has illegal funding, the criteria for enforcement remain unclear (Zabyelina and van Uhm 2020). Subnationally, the conflation of informal and illegal miners contributed to increased stigma around ASM. The raids continued to impact many of the miners who were in the process of legalizing their activities (Damonte 2018).

Despite the increased coercion, the legalization process continued to be a failure. The federations coordinated simultaneous protests across the country (SPDA Actualidad Ambiental 2013). At that stage, the miners began highlighting the mistake in the law — lack of offices and personnel to comply with the requirements, high costs, lack of differentiation among actors in the supply chain and the lack of distinction between type of deposits (Fowks 2014). The state was then forced to reduce the bureaucracy associated with the legalization process and postpone the deadlines, but it continued implementing more restrictions on the activity. Each interdiction had an average cost of US\$300,000 and by then, the budget for the interdictions was nine times greater than the one for legalization itself (La República 2018).

As the tension and violence increased, subnational officials such as mayors and regional governors in key mining regions sided with the miners. They joined the miners in the protests and often disobeyed the central state's mandates. Many disagreed with the legalization plan and given ASM's contribution to the local economies, they did not agree with the coercive strategy (Toledo Orozco 2022). By 2014, mining protests had gone national. Four thousand miners mobilized to protest at Congress in Lima (El Comercio 2014). Moreover, studies showed that deforestation from mining was increasing in new areas, which meant that the apparent reduction in mining operations was not real (La República 2018). Mining activities did not cease; they moved to other places. After facing a high degree of opposition from different actors, strong criticism of the law and the failure of the legalization process, the law could not stand. The next government of Pedro Pablo Kuczynski derogated the law and initiated a whole new process.

Considering the state's large investment, what were the outcomes of coercion?
In a miner's words:

Would you trust a state that does not talk to you, does not want to hear you, and then persecutes you? I don't. I don't want them here, I just want to work ...
(Interview member of FEDEMIN, Lima, July 25, 2018)

Coercion created a great threat that served as an incentive for miners to organize. However, given the state's unwillingness to negotiate, this organization resisted by mobilizing different actors and highlighting the gaps in the law. In the long run, coercion meant the miners distrusted engagement with the state and with legalization. To date, only 11 per cent of the mining population has decided to participate in the legalization process (RPP 2022).

Second, beyond legalization, coercion did not help the state acquire knowledge of the activity, deter the activity's expansion or improve its practices. As a result of the boom, the number of miners, the illegal traffic in implements used for mining and the amount of ASM gold illegally exported increased (OEA 2022). "[For the interdictions to work] we should be coming every 15 days but, given the time and the limited resources we cannot do that," explained the head of the mining interdictions in Peru (Interview in *El Comercio* 2015). No substantive evidence of improvements in safety or environmental regulations has been found in most of the mining towns, either (Ojo Público 2022).

Finally, coercion also impacted local dynamics. By persecuting miners and labelling ASM as illegal, the state shut down legal sources for them to fund their activities. Miners had no access to credit or training. Far from contributing to exercising the state's control over resources, coercion pushed the miners to look for alternative forms of financing, often associated with illegal actors (OEA 2022). In other cases, miners moved to illegal operations such as coca leaf production or criminal activities (Neves 2019). ASM's clandestine expansion and the presence of criminal groups in new areas have also resulted in a significant increase in the violence in mining towns (Inforegion 2021).

CONCLUSIONS AND POLICY RECOMMENDATIONS

Three key aspects emerge from our study:

In the long run, states are better off co-operating with informal miners than coercing them.

The state's challenges in forcing regulations on informal miners are myriad: On the one hand, ASM creates important economic losses, socio-environmental problems and competing pressures for the state to address informal economic markets. On the other hand, the great degree of ASM's complexity and limited institutional capacities constrain the state's power to enforce regulations. We argue that co-operation is a better strategy than coercion to enforce compliance. Coercion involves significant spending and constant action and does not guarantee success. It might offer positive results in the short term, as in Peru with the temporary cessation of ASM in mining towns, but in the long run it neither incentivizes rule compliance nor helps reduce the number of informal miners. On the contrary, it can contribute to spreading the activity to new areas. To the authors' knowledge, there is no case in the global south where coercive approaches deterred

the expansion, or fostered the improvement, of ASM. In other parts of South America, such as Colombia (Solidaridad 2020), and in sub-Saharan Africa (Sauerwein 2020), coercive strategies aggravated existing problems.

By contrast, co-operation — including the informal miners in policy enforcement — is more effective for increasing compliance. Co-operation allows states to develop relevant and feasible policies, integrate the perspective of those directly affected by such policies and reduce resistance. Co-operation implies commitment from the parties involved, creates ties and thereby fosters obedience. Our evidence suggests that co-operation between the state and informal miners is more productive for increasing compliance than are other unilateral state efforts such as reducing the size of bureaucracy for legalization or setting hard deadlines.

Of course, this policy recommendation involves several tradeoffs. Of greatest concern is that the state will not be able to pursue aggressive legislation, radically increase its royalties or obtain results quickly. Moreover, by resisting coercive strategies, the state risks alienating allies and foreign agencies from the large-scale mining sector. These tradeoffs represent significant costs to co-operation; thus, it is far from a perfect approach to developing policy. However, despite all this, our analysis shows it to be the more effective strategy of two non-ideal state options because ultimately, maintaining (and strengthening) state-informal miners ties facilitates the miners' adoption of regulations. The state sacrifices swift change to build long-term relationships that will allow the miners to commit to the rules.

To produce effective regulation, states need to first develop deep knowledge of ASM in conjunction with local actors.

The cases highlight the need for the state to develop deep knowledge of ASM. By deep knowledge we mean not only the amount of gold illegally exported, but also the techniques, implements, people, routines and the supply chain around ASM in different geographic contexts. Knowledge grants the state power, authority and autonomy to regulate and enforce the laws. As we observed in Peru, one of the regulation's weaknesses was that it was not aligned with local conditions; hence, it was not feasible. This gap works against the state's authority, increases distrust and favours non-compliance. The state can reduce the knowledge gaps by partnering with local actors such as subnational officials, members of civil society, mining leaders and communities who understand the particulars of the activity. The partnership can also contribute to identifying common interests and positive incentives so that the state can promote better practices and the legalization of ASM.

Regulation needs to be accompanied by the state's strong presence on the ground.

The state needs to accompany its strategies with a strong presence on the ground. Institutional presence in the form of offices, personnel and resources signals interest and a commitment to regulating the activity while also affirming the state's authority. Presence also means creating alternative sources of employment to reduce the heavy dependency on mining. Even in Bolivia, where miners and the state co-operate, miners can prove contentious because they have a great degree of political influence in the mining towns and no counterforce to regulate them. To gain the upper hand, ensure compliance and enforce penalties, the state needs to physically expand to the mining towns and develop strategies for economic diversification.

APPENDIX: COMPLETE MODEL SOLUTION

In this appendix, we present the full solution to the sequential model in the text. For reference, we present the game tree and tables of parameters and utilities from the main text body below.

Figure A1: Complete Sequential Model

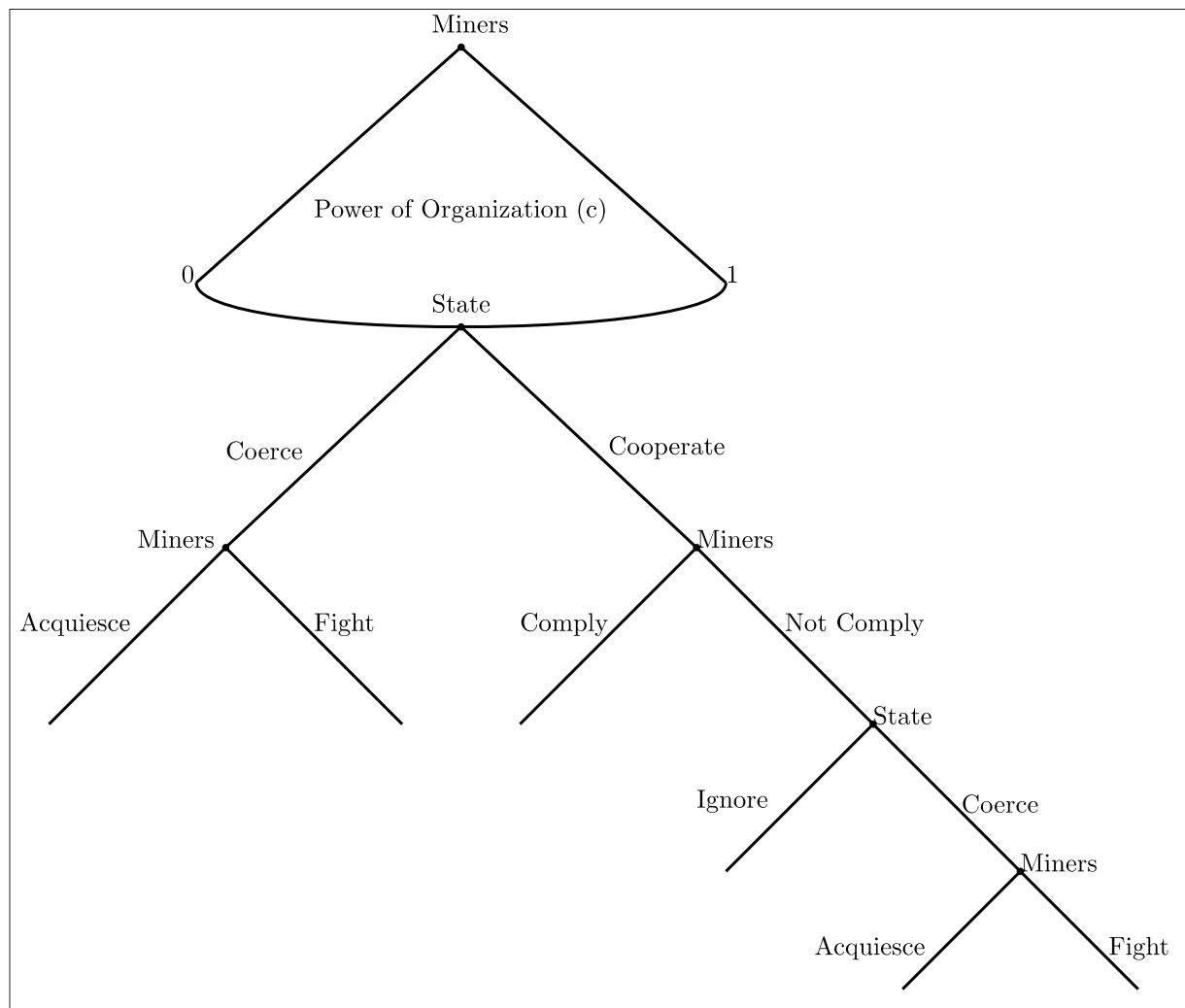


Table A1: Variables and Potential Values

Variable	Definition	Range of Values
m	Share of mining territory controlled by informal miners	$m \in (0,1)$
c	Informal miners' power of organization	$c \in (0,1)$
T	Tax rate under state regulations	$T \in (0,1)$
p	Probability that informal miners succeed when fighting the state	$p \in (0,1)$
r	State's cost of coercing the informal miners	$r > 0$
ϵ	Cost of wasted effort if co-operation fails	$\epsilon > 0$

Table A2: Summary of Utility Functions for All Possible Actions

State Strategy	Informal Miners' Strategy	Utility of State	Utility of Informal Miners
Co-operate	Comply	$T(1 - m) + Tm(1 - c)$	$m - Tm(1 - c) - c^2$
Co-operate, Ignore	Not Comply	$T - Tm - \epsilon$	$m - c^2$
Co-operate, Coerce	Not Comply, Acquiesce	$T - r$	$m - Tm - c^2$
Co-operate, Coerce	Not Comply, Fight	$(1 - p)(T - r) + p(T - Tm - r)$	$p(m - c^2) + (1 - p)(m - Tm - c^2)$
Coerce	Acquiesce	$T - r$	$m - Tm - c^2$
Coerce	Fight	$(1 - p)(T - r) + p(T - Tm - r)$	$p(m - c^2) + (1 - p)(m - Tm - c^2)$

First, we consider what happens if the state's first move is to co-operate with the miners. We solve this model using backwards induction, and thus begin with the final selection: whether the informal miners will acquiesce or fight coercion.

This model is solved using backwards induction. We begin with the right side of the game tree, where the state's first action is to co-operate with miners.

Informal miners' responses to coercion:

The last decision that the informal miners make is whether to acquiesce or fight when faced with a coercive state.

Lemma 1: The informal miners will always fight if the probability of victory is greater than zero.

Proof:

The informal miners will fight coercion when:

$$p(m - c^2) + (1 - p)(m - Tm - c^2) > m - Tm - c^2 \quad (1)$$

This inequality is true whenever

$$pTm > 0 \quad (2)$$

$$p > 0 \quad (3)$$

Thus, when faced with coercion, the miners will always fight.

State decision whether to ignore or coerce:

Given that the informal miners will fight coercion, the state must decide whether to ignore the miners or coerce them. The state will coerce the miners when:

$$(1 - p)(T - r) + p(T - Tm - r) > T - Tm - \epsilon \quad (4)$$

$$r + pTm < Tm + \epsilon \quad (5)$$

$$\epsilon > r + Tm(p - 1) \quad (6)$$

Thus, the state will choose coercion when the effort spent on co-operation is greater than the repression cost plus the product of the potential tax income on miners and the probability of miner victory minus one. Since $Tm(p - 1)$ is always negative, this is true for most repression costs.

Informal miners' decision whether to comply with co-operative strategies or not comply with co-operative strategies:

When the state decides to co-operate, the miners must decide whether to comply with co-operative strategies or not comply, knowing that if they do not comply, the state will use coercion. The miners will comply with co-operative strategies when:

$$m - Tm(1 - c) - c^2 > p(m - c^2) + (1 - p)(m - Tm - c^2) \quad (7)$$

$$Tmc > pTm \quad (8)$$

$$c > p \quad (9)$$

Thus, the miners will comply whenever the power of organization is greater than the probability of victory. This is a reasonable assumption since the probability of victory can never be one, but the power of co-operation can be, and the probability of victory increases with the power of organization.

We then move to the left side of the game tree, where the state begins with coercion.

Informal miners' decision to acquiesce or fight:

Per lemma 1, informal miners will always fight against coercion.

State decision to cooperate or coerce:

We then evaluate whether the state will co-operate, knowing that informal miners will comply, or coerce, knowing that miners will fight. The state will co-operate when:

$$T(1 - m) + Tm(1 - c) > (1 - p)(T - r) + p(T - Tm - r) \quad (10)$$

$$- Tmc > - rc - pTm \quad (11)$$

$$rc > Tmc - pTm \quad (12)$$

$$rc > Tm(c - p) \quad (13)$$

$$r > \frac{Tm(c - p)}{c} \quad (14)$$

$$r > Tm - \frac{pTm}{c} \quad (15)$$

The state is more likely to prefer cooperation as the miners have a higher level of collective action.

Informal miners select power of organization:

Finally, the miners, knowing that the state will co-operate and they will comply, must select the power of organization that will maximize their utility. The miners' expected payoff when the state co-operates is $m - Tm(1 - c) - c^2$. This is a concave function, and the miners maximize their utility when the derivative of the function is equal to zero.

$$\frac{d}{dc} m - Tm(1 - c) - c^2 = 0 \quad (16)$$

$$Tm - 2c = 0 \quad (17)$$

$$c = \frac{Tm}{2} \quad (18)$$

The miners maximize their utility when the power of organization is $\frac{Tm}{2}$, and the miners select this power of organization.

The final equilibrium is:

Miners: $\{c = \frac{Tm}{2}, \text{ fight coercion, comply with co-operation, fight coercion}\}$

State: $\{\text{Co-operate, Coerce if miners do not comply}\}$

REFERENCES

- Alianza por la Minería Responsable. 2022. *Modelamiento financiero-fiscal para la minería de pequeña escala*. Bonn and Eschborn: GIZ.
- Andina. 2013. "Suspenderán entrega de nuevas licencias para grifos en zonas de minería ilegal." *Andina*. October 29. Accessed June 25, 2022. <https://andina.pe/agencia/noticia-suspenderan-entrega-nuevas-licencias-para-grifos-zonas-mineria-ilegal-480396.aspx>.
- Aranibal, Ana Maria, Eliodoro Sandi, and Daniel Lafuente. 2017. *Mujeres Mineras en Bolivia. Una mirada a su realidad socioeconómica*. La Paz: Solidaridad.
- Baraybar, Viviana, and Eduardo Dargent. 2020. "State Responses to the Gold Rush in the Andes (2004–2018): The Politics of State Action (and Inaction)." *Studies in Comparative International Development* 55: 516–537.
- Cano, Álvaro. 2021. *Formalización de la Minería Artesanal y de Pequeña Escala en la Amazonía peruana: lecciones aprendidas y propuestas de solución*. Lima: USAID.
- Cremers, Leontien, Judith Kolen, and Marjo de Theije. 2013. *Small-Scale Gold Mining in the Amazon. The Cases of Bolivia, Brazil, Colombia, Peru and Suriname*. The Netherlands: CEDLA.
- Damonte, Gerardo. 2018. "Mining Formalization at the Margins of the State: Small-scale Miners and State Governance in the Peruvian Amazon." *Development and Change* 49 (5): 1314–1335.
- . 2021. "Limited State Governance and Institutional Hybridization in Alluvial ASM in Peru." *Resources Policy* (72): 102118.
- Dargent, Eduardo, Andreas Feldmann, and Juan Pablo Luna. 2017. "Greater State Capacity, Lesser Stateness: Lessons from the Peruvian Commodity Boom." *Politics and Society* 3–34.
- Defensoría del Pueblo. 2014. *Balance de la gestión estatal frente a la minería informal e ilegal en el Perú. 2012 - 2014. Informe N 167*. Lima: Defensoría del Pueblo.
- Dunkerley, James. 1984. *Rebellion in the Veins: Political Struggle in Bolivia 1952-1982*. London: Verso Books.
- El Comercio. 2014. *Marcha de mineros ilegales: miles seguirán hoy con protestas*. March 21. Accessed May 4, 2022. <https://elcomercio.pe/peru/marcha-mineros-ilegales-miles-seguiran-hoy-protestas-303494>.
- El País. 2014. "Dos mineros mueren durante las protestas contra el Gobierno boliviano." April 1. Accessed August 30, 2022. https://elpais.com/economia/2014/04/02/agencias/1396467029_669166.html.
- Fowks, Jacqueline. 2014. "Disturbios en Perú tras no llegar a un acuerdo Gobierno y mineros informales." *El País*. March 23. Accessed August 30, 2022. https://elpais.com/internacional/2014/03/23/actualidad/1395538572_696866.html

- GIATOC. 2016. *Organized Crime and Illegally Mined Gold in Latin America*. Switzerland: The Global Initiative Against Transnational Organized Crime.
- Hilson, Gavin, and James McQuilken. 2014. "Four Decades of Support for Artisanal and Small-Scale Mining in sub-Saharan Africa: A Critical Review." *The Extractive Industries and Society* 1 (1): 104-118.
- IISD – International Institute For Sustainable Development. 2018. *Global Trends in Artisanal and Small-Scale Mining (ASM): A Review of Key Numbers and Issues*. Winnipeg: IISD.
- Inforegion. 2021. Madre de Dios: Así opera el crimen organizado que protege a la minería ilegal. September 2. Accessed February 2, 2022. <https://www.inforegion.pe/288919/madre-de-dios-asi-opera-el-crimen-organizado-que-protege-a-la-mineria-ilegal/>.
- La Razón. 2013. "La futura Ley de Minería exige a cooperativas del pago de 5 tributos." *La Razón*. Julio 16. Accessed June 25, 2022. <https://www.la-razon.com/lr-article/la-futura-ley-de-mineria-exime-a-cooperativas-del-pago-de-5-tributos/>.
- La República. 2014. "Alto Comisionado no cree que paro de mineros vaya a ser 'representativo.'" February 11. Accessed January 2, 2022. <https://larepublica.pe/politica/771776-alto-comisionado-no-cree-que-paro-de-mineros-vaya-a-ser-representativo/>.
- . 2018. "Minería ilegal crece pese a operativos." May 17. Accessed January 2, 2022. <https://larepublica.pe/politica/1244619-mineria-ilegal-crece-pese-operativos-interdccion/>.
- Lahiri-Dutt, Kuntala. 2018. *Between the Plough and the Pick. Informal, Artisanal and Small-Scale Mining in the Contemporary World*. Vol. 28. Acton: Australian National University Press.
- Le Billon, Philippe. 2008. "Diamond Wars? Conflict Diamonds and Geographies of Resource Wars." *Annals of the Association of American Geographers* 98 (2): 345-372.
- Marshall, Bruce, and Marcello Veiga. 2017. "Formalization of Artisanal Miners: Stop the Train, We Need to Get Off!" *The Extractive Industries and Society* 4 (2): 300-303.
- Marston, Andrea. 2019. "Vertical Farming: Tin Mining and Agro-Mineros in Bolivia." *The Journal of Peasant Studies* 1-21.
- MINEM. 2021. Listado de Mineros Formalizados. http://www.minem.gob.pe/_detalle.php?idSector=20&idTitular=8078&idMenu=sub8048&idCateg=1449.
- Mosquera, Cesar, Mary Luz Chavez, Victor Hugo Pachas, and Paola Moschella. 2009. *Estudio Diagnóstico de la Actividad Minera Artesanal en Madre de Dios*. Lima: Fundación Conservación Internacional.
- Neves, Yuri. 2019. *Control de minería ilegal en Perú podría conducir a otras actividades criminales*. June 18. Accessed June 24, 2022. <https://es.insightcrime.org/noticias/analisis/control-mineria-ilegal-peru/>.

- OEA. 2022. *Tras el dinero del oro ilícito: Fortalecimiento de la lucha contra las finanzas de la minería ilegal. El caso de Perú*. Washington: Departamento contra la Delincuencia Organizada Transnacional. Organización de Estados Americanos.
- Ojo Público. 2022. “La minería informal se extiende por la Amazonía sin control ni cifras oficiales.” *Ojo Público*. June 5. Accessed June 25, 2022. <https://ojo-publico.com/3529/la-mineria-informal-se-extiende-por-la-amazonia-sin-control>.
- Okada, Isamu. 2016. “Evo Morales, cooperativas mineras y el difícil parto de la nueva ley minera.” *Revista Decursos* 18 (34): 161-193.
- Página Siete. 2014a. “Editorial: Ley minera, conflicto desbocado.” *La Razon*. April 5. Accessed June 25, 2022. <https://www.paginasiete.bo/opinion/2014/4/6/minera-conflicto-desbocado-18118.html>.
- . 2014b. “Evo pide debate de ley minera con razones y no con caprichos.” January 17.
- . 2014c. “Conozca 10 aspectos de nueva ley minera.” *Página Siete*. April 5. Accessed June 25, 2022. <https://www.paginasiete.bo/economia/conozca-10-aspectos-de-nueva-ley-minera-CPPS18163>.
- Pachas, Victor. 2011. *Historia de una Incertidumbre: Hábitat, Conflicto y Poder en la Minería Artesanal de Oro de Perú*. Lima: Earth First.
- Poveda, Pablo. 2014. *Formas de producción de las cooperativas mineras en Bolivia*. La Paz: CEDLA.
- Poveda, Pablo, Hector Cordova, Pablo Pulido, William Sacher, Lino Joao de Oliveira, Estafanía Daró, and Pía Marchegiani. 2015. *La Economía del Oro en Sudamérica. Ensayos sobre la explotación en Sudamérica*. La Paz: CEDLA.
- Poveda, Pablo, Neyer Nogales, and Ricardo Calla. 2015. *El Oro en Bolivia. Mercado, Producción y Medio Ambiente*. La Paz: CEDLA.
- Rettberg, Angelika, and Juan Felipe Ortiz-Riomalo. 2016. “Golden Opportunity, or a New Twist on the Resource-Conflict Relationship: Links Between the Drug Trade and Illegal Mining in Colombia.” *World Development* 84: 82-96.
- Reuters. 2012. *Reforma minera en Bolivia, demorada al menos hasta 2013: ministro*. October 31. Último acceso: June 25, 2022. <https://www.reuters.com/article/portada-mineria-bolivia-idLTASIE89U07T20121031>.
- RPP. 2022. “Solo el 11% de mineros informales completó proceso de formalización.” *RPP*. June 23. Accessed June 25, 2022. <https://rpp.pe/economia/economia/solo-el-11-de-mineros-informales-completaron-proceso-de-formalizacion-noticia-1413510>.
- Salo, Matti, Juha Hiedanpää, Teemu Karlsson, Luciano Cárcamo, Juha Kotilainen, Pekka Jounela, and Roger Rumrill. 2016. “Local Perspectives on the Formalization of Artisanal and Small-Scale Mining in the Madre de Dios Gold Fields, Peru.” *The Extractive Industries and Society* 3 (4): 1058-1066.
- Sauerwein, Titus. 2020. “Gold Mining and Development in Côte d’Ivoire: Trajectories, Opportunities and Oversights.” *Land Use Policy* 91: 104323.

- Solidaridad. 2020. *Análisis comparado sobre la formalización de la minería a pequeña escala en Colombia, Bolivia, Ecuador y Perú*. Lima: Solidaridad.
- SPDA Actualidad Ambiental. 2013. *Federaciones mineras acuerdan paros en cadena desde el 19 de agosto*. August 9. Accessed May 3, 2022. <https://www.actualidadambiental.pe/federaciones-mineras-acuerdan-paros-en-cadena-desde-el-19-de-agosto/>.
- SPDA. 2015. *La Ruta del Oro Ilegal. Estudios de Caso en Cinco Países*. Lima: Sociedad Peruana de Derecho Ambiental.
- Sulmont, Denis. 1980. *Historia del Movimiento Obrero Minero Metalúrgico*. Prod. Federación Nacional de Trabajadores Mineros Metalúrgicos del Perú: Lima.
- The Artisanal and Small-scale Mining Knowledge Sharing Archive. 2022. Accessed January 25, 2022. <http://artisanalmining.org/Inventory/>.
- The Artisanal Gold Council. 2017. *Reporte de Inventario. Estimaciones de referencia del uso y consumo de mercurio en la minería de oro artesanal y de pequeña escala en Perú*. Lima: The Artisanal Gold Council.
- Toledo Orozco, Zarái. 2022. "Informal Gold Miners, State Fragmentation and Resource Governance in Bolivia and Peru." *Latin American Politics and Society* 64 (2): 45-66.
- Toledo Orozco, Zarái, and Marcello Veiga. 2018. "Locals' Attitudes Toward Artisanal and Large-Scale Mining: A Case Study in Tambogrande, Peru." *The Extractive Industries and Society* 327-334.
- Tubb, Daniel. 2020. *Shifting Livelihoods: Gold Mining and Subsistence in the Chocó, Colombia*. Seattle: University of Washington Press.
- USAID. 2017. «Illegal gold mining.» USAID from the American People. <https://www.usaid.gov/peru/our-work/illegal-gold-mining>.
- Veiga, Marcello. 1997. *Introducing New Technologies for Abatement of Global Mercury Pollution in Latin America*. Rio de Janeiro: UNIDO, UBC and CETEM.
- Verbrugge, Boris. 2015. "Undermining the State? Informal Mining and Trajectories of State Formation in Eastern Mindanao, Philippines." *Critical Asian States* 47 (2): 177-199.
- Zabyelina, Yuliya, and Daan van Uhm. 2020. *Illegal Mining. Organized Crime, Corruption, and Ecocide in a Resource-Scarce World*. Switzerland: Palgrave Macmillan.



ABOUT THE AUTHOR

Zaraí Toledo Orozco is a postdoctoral fellow at the Center for Inter-American Policy and Research at Tulane University. She received her Ph.D. in Political Science from the University of British Columbia in 2020. Zaraí explores the expansion of informal governance systems around small-scale and artisanal gold mining in the Andes and regulatory enforcement. Zaraí has worked in Peru, Colombia and Ecuador with policy makers, community leaders and the private sector assessing regulatory frameworks, developing community consultations, and coordinating training programs for best mining practices.

Katherine McKiernan is a postdoctoral fellow at the Center for Inter-American Policy and Research (CIPR) at Tulane University. She received her Ph.D. in Political Science from the University of North Carolina at Chapel Hill in 2020. Her research focuses on distributive politics, with a particular focus on how politicians allocate club goods, in Latin America. She is also interested in how clientelist dynamics change in weak party systems.

ABOUT THE SCHOOL OF PUBLIC POLICY

The School of Public Policy has become the flagship school of its kind in Canada by providing a practical, global and focused perspective on public policy analysis and practice in areas of energy and environmental policy, international policy and economic and social policy that is unique in Canada.

The mission of The School of Public Policy is to strengthen Canada's public service, institutions and economic performance for the betterment of our families, communities and country. We do this by:

- *Building capacity in Government through* the formal training of public servants in degree and non-degree programs, giving the people charged with making public policy work for Canada the hands-on expertise to represent our vital interests both here and abroad;
- *Improving Public Policy Discourse outside Government* through executive and strategic assessment programs, building a stronger understanding of what makes public policy work for those outside of the public sector and helps everyday Canadians make informed decisions on the politics that will shape their futures;
- *Providing a Global Perspective on Public Policy Research* through international collaborations, education, and community outreach programs, bringing global best practices to bear on Canadian public policy, resulting in decisions that benefit all people for the long term, not a few people for the short term.

The School of Public Policy relies on industry experts and practitioners, as well as academics, to conduct research in their areas of expertise. Using experts and practitioners is what makes our research especially relevant and applicable. Authors may produce research in an area which they have a personal or professional stake. That is why The School subjects all Research Papers to a double anonymous peer review. Then, once reviewers comments have been reflected, the work is reviewed again by one of our Scientific Directors to ensure the accuracy and validity of analysis and data.

The School of Public Policy

University of Calgary, Downtown Campus
906 8th Avenue S.W., 5th Floor
Calgary, Alberta T2P 1H9
Phone: 403 210 3802

DISCLAIMER

The opinions expressed in these publications are the authors' alone and therefore do not necessarily reflect the opinions of the supporters, staff, or boards of The School of Public Policy.

COPYRIGHT

Copyright © Orozco, McKiernan 2022. This is an open-access paper distributed under the terms of the Creative Commons license CC BY-NC 4.0, which allows non-commercial sharing and redistribution so long as the original author and publisher are credited.

ISSN

ISSN 2560-8312
The School of Public Policy
Publications (Print)
ISSN 2560-8320
The School of Public Policy
Publications (Online)

DATE OF ISSUE

November 2022

MEDIA INQUIRIES AND INFORMATION

For media inquiries, please contact Dana Fenech at 403-210-6508.

Our web site, www.policyschool.ca, contains more information about The School's events, publications, and staff.

DISTRIBUTION

For a full list of publications from The School of Public Policy, please visit www.policyschool.ca/publications