On the Origins of the State: Stationary Bandits and Taxation in Eastern Congo

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A positive demand shock for coltan, a mineral whose bulky output cannot be concealed, leads armed actors to create illicit customs and provide protection at coltan mines, where they settle as "stationary bandits." A similar shock for gold, easy to conceal, leads to stationary bandits in the villages where income from gold is spent, where they introduce illicit mining visas, taxes, and administrations. Having a stationary bandit from a militia or the Congolese army increases welfare. These findings suggest that armed actors may create "essential functions of a state" to better expropriate, which, depending on their goals, can increase welfare.

I. Introduction

Economists typically presuppose environments where property rights and contracts are enforced by a state. Typically, however, states appeared

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late through history, and the essential functions of a state—"monopoly of violence," taxation, and protection of the property of those who are taxed—were likely central for modern economic growth (Bates 2001).[1]

When do the essential functions of a state emerge? Historical research suggests that their origins might be in the activities of armed actors (Tilly 1985). Indeed, while many armed actors typically ended as organized crime, the historical record documents that the most successful were the precursors of today's states (Weber 1946; Olson 1993). However, a challenge to examine this question is that statistics were first created by states (Scott 1998). Thus, currently available data would not allow statistical analysis of their origins systematically.[2]

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[1] Tilly (1985, 181) defines the essential functions as follows: "Under the general heading of organized violence, the agents of states characteristically carry on four different activities:

1. War making: Eliminating or neutralizing their own rivals outside the territories in which they have clear and continuous priority as wielders of force
2. State making: Eliminating or neutralizing their rivals inside those territories
3. Protection: Eliminating or neutralizing the enemies of their clients
4. Extraction: Acquiring the means of carrying out the first three activities – war making, state making, and protection."

Put another way, "A state's essential minimum activities form a trio: *statemaking*: attacking and checking competitors and challengers within the territory claimed by the state; *warmaking*: attacking rivals outside the territory already claimed by the state; *protection*: attacking and checking rivals of the rulers' principal allies, whether inside or outside the state's claimed territory. No state last long, however, that neglects a crucial fourth activity: *extraction*: drawing from its subject population the means of statemaking, warmaking, and protection" (Tilly 1990, 96). Also, "From the short-run perspectives of ordinary people, what we in blithe retrospect call 'state formation' included the setting of ruthless tax farmers against poor peasants and artisans, the forced sale for taxes of animals that would have paid for dowries, the imprisoning of local leaders as hostages to the local community's payment of overdue taxes, the hanging of others who dared to protest, the loosing of brutal soldiers on a hapless civilian population, the conscription of young men who were their parents' main hope for comfort in old age" (Tilly 1990, 98–99). Finally, Grossman (1994, 705) notes, "Throughout history the responses of human societies to the problems of distributing property and of allocating resources between productive and appropriative activities probably have had greater consequences for welfare than have their responses to the problem of allocating resources among different productive activities taking property rights as given, which is the problem on which economic analysis traditionally has focused."

[2] Scholars of the early state argue that the absence of systematic disaggregated data is a major constraint to the development of their field: "Consideration of the political economy of early states is urgent, but one reason it has been neglected is that information on it is so poor" (Southall 1991, 77). However, many examples of well-documented experiences of state formation exist. Mexico's Oaxaca Valley before 200 AD, ancient Titicaca, and Polynesia at the turn of the nineteenth century are examples of this (Marcus and Flannery 1996; Flannery and Marcus 2014). Claessen and Skalnik (1978) and Keeley (1996) gather evidence of stateless societies and early states. Marcus and Flannery (1996) argue, "A battle is one of the hardest events to document with archaeological evidence," and "even in

The Democratic Republic of the Congo (DRC) provides a suitable setting to examine the emergence of the essential functions of a state. The central government has lost direct control of vast areas of the east, allowing numerous armed actors and also individuals affiliated to the Congolese army to engage in criminal activities since 1990. They regularly establish illegal monopolies of violence, offer protection, raise illegal taxes, run administrations illegally—thus privately providing "essential functions of a state"—and often enjoy more legitimacy than the central government.[3] Sometimes, they are a de facto government. In this period, large changes in demand for minerals extracted in the east influenced their incentives to invest, or disinvest, in such functions (Nest, Grignon, and Kisangani 2011; Stearns 2011; Verweijen 2013; Stearns and Vogel 2017; Sánchez de la Sierra 2018).

As a foundation for this study, I assembled a yearly panel data set on the behavior of armed actors since 1995 in 650 locations in the eastern DRC. Drawing on the theory of optimal taxation, I suggest that, if production can be observed, a higher value of output increases the returns to taxing production, providing protection, and, ultimately, creating a monopoly of violence in the location in which output is produced—the essential functions of a state. Instead, if production cannot easily be observed, a higher value of output increases the returns to taxing people and consumption and to creating an administration to support the collection of such more sophisticated taxes.

To establish a causal relationship, I exploit two demand shocks for minerals extracted in the eastern DRC, for which the DRC is a price taker. At the start of 2000, Sony announced the release of a new video-game console for Christmas, Playstation II, which used columbite-tantalite (called "coltan" in the DRC) as a key input. Columbite-tantalite-processing firms began a rush for coltan in the DRC, pushing the US price from $90 to $590 per kilogram before it collapsed during the Christmas season upon the failure of Playstation II. Then, following the global recession, investors rushed to gold as a safe haven—a mineral whose highly valuable and tiny daily output is impossible to tax, pushing up the price of gold sharply, especially after 2006.

The first result is that, in response to an increase in the price of coltan, armed actors create monopolies of violence; that is, they emerge as "stationary bandits" (Olson 1993), create illegal customs to tax mining output, and provide protection in the mines where coltan is produced—thus creating Tilly (1985)'s "essential functions of a state." This effect,

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regions subdued by force it might require incredible luck to find archaeological evidence for a battle."

[3] The DRC is considered a "failed state" (Fund For Peace 2013). Raeymaekers (2013, 613) notes, "The expansion of this military-commercial nexus . . . depends on the exploitative tribute armed parties can raise . . . productive enclaves of negotiated peace in a sea of unprotected statelessness."

driven by mines near airports where coltan can be shipped or exported, is led by nonstate armed actors, more prevalent during that shock, often seen as more legitimate than the state. However, in response to the positive demand shock for gold, whose output miners can easily conceal, stationary bandits emerge not at the mines but in the villages where miners' families live—the consumption economies (support villages), where they also provide protection and, failing to tax mining output directly, introduce systems of working permits on mining labor. This effect is driven by privately provided criminal activities of Congolese army individuals, more prevalent during the gold price shock.

The second result is that, when the stationary bandit's mission encompasses the population's well-being (popular militia and Congolese army actors), having a stationary bandit benefits household welfare on net. First, the price shocks lead proxies for household welfare (asset ownership, weddings, and migration) to increase significantly more in locations that have a stationary bandit only if they are affiliated to a militia or the Congolese army. Second, having a stationary bandit from a militia or the Congolese army increases household welfare, but having one from external armed actors does not. To support a causal interpretation, I instrument for the presence of a given stationary bandit, using the timing and targeting of a major peace agreement.

The third result is that the gold shock induces stationary bandits to intensify the essential functions they create. In response to a higher gold price, armed actors introduce working permits as well as other more sophisticated taxation systems (poll taxes, taxes for selling in the local food market), in the sense that these taxes are more difficult to collect, and they develop a fiscal administration to support their tax collection efforts, as well as a judicial administration. Such an effect holds even when the econometric specification accounts for changes in the composition of stationary bandits. The coltan price, in contrast, leads stationary bandits to dismantle the fiscal and judicial administrations in coltan support villages, an administration "resource curse." This suggests that the opportunity costs of different tax-revenue-generating activities govern the allocation of the stationary bandits' limited resources.

The findings of this paper complement scholarship on the origins and trajectories of the essential functions of the state. First, history abounds with examples of armed organizations aiming to govern. The most successful ended up forming states, but many such "states-in-the-making" disappeared (Tilly 1975). While this process is typically taken as given in economics, other social sciences study it as a recurrent process of state formation that is never complete. Second, the contractarian view of state formation, hypothesized in philosophy (Hobbes 1651; Rousseau 1762), conceives states as arising from popular will and uses this to explain their positive effect on welfare, while on the other hand, the conflict view, dominant

in anthropology and sociology, views states as successful organized crime. The findings of this paper suggest that, when they emerge from popular mobilization, the essential functions of a state can arise from both processes and can have a positive effect on the population's welfare. Third, the findings propose an explanation for Tilly (1985)'s "essential functions of the state" at its early stages, as well as their "maturing" (Ardant 1975), two phases studied in the sociology literature (Claessen and Skalnik 1978).

The paper also complements the study of civil war in economics, usually constrained by the absence of high-quality panel data (Blattman and Miguel 2010). These data allow me to complement existing explanations of violence. First, Dal Bó and Dal Bó (2011) and Dube and Vargas (2013) suggest that a rise in the price of a capital-intensive commodity increases violence and explain it as a "rapacity effect," as armed actors fight for the resource. This paper suggests that such an effect may cover subtler changes linked to the ways in which the value is extracted, which can lead to the emergence of the essential functions of a state—and potentially to their intensification. Second, the disaggregated panel data allow me to estimate causal relationships, an approach that, with some exceptions, is still rare (Reno 1999; Weinstein 2007; Dube and Vargas 2013; Maystadt et al. 2014; Nunn and Qian 2014; Arjona, Kasfir, and Mampilly 2015; Parker and Vadheim 2016; Koenig et al. 2017).

Finally, this paper proposes a new type of "resource curse" (Bannon and Collier 2003). Two common empirical observations are used in the resource curse literature to suggest that mineral endowments can have a negative effect on the political equilibrium. First, countries that have mineral resources are more prone to conflict. This is often explained as a rapacity effect, as nonstate armed actors have an incentive to seize the state or its property (Bazzi and Blattman 2014). Second, governments that have access to revenue from resources are less dependent on the population for fiscal revenue, potentially reducing government accountability—the "rentier state."

While the resource curse literature typically takes administration capacity as given, the findings of this paper suggest that administration capacity may itself be endogenous to resource booms. If taxing production is impossible, a resource boom increases the returns to creating a fiscal administration to tax income, consumption, and wealth. However, if production can be taxed, a resource boom may lead governments to create customs taxation, which requires minimal investment, and to reallocate resources away from other sources of revenue generation—thus dismantling their administrative efforts to tax consumption and people. While full-fledged bureaucracies are likely slower to change, this paper suggests that resource shocks can govern the incentives of leaders to create, or instead dismantle, "fiscal capacity" (Besley and Persson 2009), usually

taken as given in this literature—thus, temporary resource booms can have long-run effects on tax revenue.

II. Conceptualizing the Essential Functions of States

A. Motivating Example

The case of the Nduma Defense of Congo–Renouvelé (NDC-R), formed in 2008, provides a useful example of a group that belongs to the continuum that runs "from bandits and pirates to kings via tax collectors" (Tilly 1985).[4] The organization, which, in September 2017, was composed of 2,377 combatants and administrators, had the capacity to project violence in a considerable territory. It controlled 108 villages, taxed 38,480 adults, and owned 1,180 spears, 1,198 machetes, 14 guns, 40 grenades, 14 machine guns, 24 rocket-propelled grenades, 7 mortars, 2,028 AK47s, and 66 satellite phones.

To finance NDC-R's monopoly of violence, a fiscal agency collects a monthly poll tax in each village the group controls. In order to collect poll taxes, the agency conducts a population census in each village, as well as tax audits, and enlists village chiefs, following a system of tax tokens that resembles the Belgian colonial state's fiscal system. The agency is in charge of issuing mining permits and collecting mining output taxes, a weekly agricultural tax in kind (the *ration militaire*), fees on private actors for profiting from public property (the *taxe domaniale*), toll fees on transit, and even a 10% turnover tax on businesses, whose level is set to compete with the Congolese state's rate. An intelligence agency monitors the entry of traders, in order to tax them, as well as enemy activities. The agency is also in charge of administering the profits from the group's "state" monopolies over the sale of beer, liquor, and cigarettes. An administrator, called the "T1," manages the staff of an agency in charge of public finance and human resources.

The group is concerned with order and popular support and, for that purpose, has created a legal system. Sexual offenses, tax evasion, espionage, and theft are penalized. Furthermore, an agency for the relationship with civilians frequently conducts so-called sensibilization campaigns to inform the population about the group's mission (and persuade them to endorse it) as well as to obtain voluntary recruits. The general frequently

[4] Many examples found in my own fieldwork in the DRC between 2010 and 2018 show similar patterns. This investigation includes conversations with active officers and combatants of the following armed groups: Nduma Defense of Congo–Sheka, Nduma Defense of Congo–Renouvelé, Mayi-Mayi Padiri, Mayi-Mayi Yakutumba, Mayi-Mayi Kifuafua, Mayi-Mayi Nyakiliba, Raia Mutomboki, Mayi-Mayi Uvira, M23 (the March 23 Movement), Mayi-Mayi APCLS (Alliance des patriotes pour un Congo libre et souverain), and the AFDL (Alliance des Forces Démocratiques pour la Libération du Congo-Zaïre), as well as their administrative documents. The argument put forward by the paper is not new (Raeymaekers 2013).

invokes ancestors of the local ethnic group to support the legitimacy of the group's mission. The group also has its own logo and anthem.

In the period of this study, the eastern DRC had a significant number of armed actors, from thousands of bandits to hundreds of semiautonomous battalions of larger organizations that, like the NDC-R, share the problems, and features, of a state in the making—including hundreds of armed actors affiliated to the Congolese army operating criminal protection rackets.[5]

B. Origins of the State and the Essential Functions of a State

1. Emergence of the Essential Functions of a State (Extensive Margin)

A dominant view of the state defines it as a "monopoly of violence" (Weber 1946):[6]

> [G]overnments stand out from [racketeers] by their tendency to monopolize the concentrated means of violence. The distinction

[5] See Raeymaekers (2013) and Stearns and Vogel (2017). See also Smith (2015, 14): "In the beginning, there was no government to speak of in the United States [of America, a mine], but over time the Mai Mai army brought law: 'The more people worked, the stronger the Mai Mai [i.e., Mayi-Mayi] army grew. They grew rich from the 50% that they earned from the diggers.'. . . [T]he United States of America was known as a relatively liberal place with many freedoms and this helped to make it a land of opportunity: 'A person could go from nothing to something, and no one cared who you were or where you were from, what your ethnicity was, so long as you were strong, and could work.' Because so many people wanted to go there, and there was a constant threat to security, when a newcomer visited the United States of America she had to apply for a visa: 'They gave you an identification card, and the Mai Mai told you, "Welcome. You are in the United States of America now, another country. You have left Congo behind." ' There were customs officials there, inspecting goods, assessing value, and placing tax." Hoffmann (2015, 20) notes, "Many preferred the justice of the armed groups, which were viewed as more accessible, effective, and cheap." Marchais (2016) writes, "Several auto-defense groups had already emerged as a result of the persistent insecurity but they were loosely organized." On the other side of the continuum, the M23 controlled 5,200 km^2 and 69,000 civilians and had ministries of corruption and environment (Gettleman 2012; see also BBC News 2012 and Radio Okapi 2012).

[6] Trotsky (1905) writes, "In any 'normally' functioning state, whatever its form, the monopoly of brute force and repression belongs to the state power. That is its 'inalienable' right, and of this right it takes the most zealous care, ever watchful lest any private body encroach upon its monopoly of violence. In this way the state organization fights for its existence." Tilly (1985, 171): "Back to Machiavelli and Hobbes, nevertheless, political observers have recognized that, whatever else they do, governments organize and, wherever possible, monopolize violence." Flannery and Marcus (2014, 476): "One of the most dramatic innovations of states is that the central government monopolizes the use of force. . . . While individuals in Sumerian society were constrained from violence and revenge, the state had the right to draft soldiers and wage war." See Claessen and van de Velde (1991). Tilly (1985, 170) writes, "The . . . argument stresses the interdependence of war making and state making and the analogy between both of those processes and what, when less successful and smaller in scale, we call organized crime. War makes states."

> between "legitimate" and "illegitimate" force, furthermore, makes no difference to the fact. If we take legitimacy to depend on conformity to an abstract principle or on the assent of the governed (or both at once), these conditions may serve to justify, perhaps even to explain, the tendency to monopolize force. (Tilly 1985, 171)

Proponents of this view define the essential functions of a state as "eliminating external rivals and oppressing internal opponents," "repressing threats to the property of the governed," and "designing the means to finance these activities" (Tilly 1985).[7] In the absence of a state, human populations are often governed by traditional chiefs, whose rule is often based on preexisting religions, social conventions, and reciprocity. Archaeological evidence suggests that the essential functions of the state first emerged when an armed elite, often foreign, aimed to collect taxes, often starting with rudimentary taxes on observable output. So-called early states were recorded as early as 3,000 years BCE.[8] A dominant explanation of their emergence is that the value of the output that can be taxed and the ease with which it can be taxed are important determinants in the elite decisions to develop such functions (Carneiro 1970; Ardant 1975; Earle 1997). Because of their extractive motive, even if many early states attempted to create ideological and religious justifications for

[7] While Tilly (1985, 1990) describes the creation of modern European states, his theoretical work permeates periods: "The argument grows from historical work on the formation of national states in western Europe. . . . But it takes several deliberate steps away . . . , wheels, and stares hard at it from theoretical ground" (Tilly 1985, 170). Baumol (1995, 84) writes, "[The economics of crime] promises to offer profound insights into the origins and workings of governments, not as most of us know them, but like those that have ruled the bulk of humanity in the past, and continue their sway in many countries today," Hirschfeld (2015, 38): "[D]emocratic governments that regulate markets and protect individual rights are recent innovations that are still not the norm." See Carneiro (1970), Service (1975), Claessen and Skalnik (1978), Cohen and Service (1978), Claessen and van de Velde (1991), Marcus and Flannery (1996), Skaperdas and Syropoulos (1996), Hirschfeld (2015), and also the evolution of states into modern states (Ardant 1971; Tilly and Ardant 1975; Tilly 1985, 1990; Scott 1998). Such state functions have been documented in the Italian Camorra and the Sicilian mafia (Gambetta 1996); gambling rackets; organized crime in America, such as the violent organizations that emerged from product prohibitions or well-studied highway gangsters in the United States of America, who established systems of tolls and protection rather than arbitrary predation (Hirschfeld 2015). Popular views tend to abstract from the underlying social process before their recognition as a state in the international state system.

[8] See Thornton (1983). Flannery and Marcus (2014) document the three main sources of chiefly power: *mana* (supernatural energy), *tohuga* (skill/expertise), and *toa* (toughness). While the rule of chiefs usually relies on supernatural powers (*mana*) and skill (*tohuga*), governing populations outside the immediate clan requires the use of toughness, or force (*toa*). States thus form when the basis of governance shifts to force, for instance, when populations are ruled by chiefs who expand their rule outside the immediate clan: "When . . . the expanded territory grows beyond the limits that a chief can administer through the *usual* methods, he is compelled to make changes in administration and political ideology, and a state begins to form" (Flannery and Marcus 2014, 365; emphasis added).

their rule, they often failed. A large number did not have legitimacy—so-called inchoate early states (Claessen and Skalnik 1978).[9]

2. Extensive Margin and Population Welfare

If state functions are used for the interest of the population—as in the case of popular militias or "inclusive" political institutions—they may enable growth through the protection of property rights they provide. However, state functions can be used to the detriment of the population welfare (Acemoglu and Robinson 2012; Heldring 2018), as evidenced by the fact that many states arise as protection rackets.[10]

3. Intensification of the Essential Functions of the State (Intensive Margin)

In some cases, moving beyond the collection of simple taxes on observable output, states "matured" along a continuum (Claessen and Skalnik 1978)—indicating state formation on the intensive margin. The trajectory of modern European states suggests that armed actors' efforts to seek tax revenue can account for changes along such an intensive margin (Ardant 1975). High-value international trade in England, which could be taxed with easy-to-administer customs, increased the focus on customs as a source of tax revenue. The French government revenues, in contrast, hinged on taxing transactions in the interior. This led the government to introduce poll and consumption taxes, tolls, rural fairs, and city walls and to create the organizational capacity to support the collection of such taxes.[11]

[9] "Frank recognition of the central place of force in governmental activity does not require us to believe that governmental authority rests 'only' or 'ultimately' on the threat of violence. Nor does it entail the assumption that a government's only service is protection" (Tilly 1985, 172). Legitimacy is also implied: "Legitimacy is the probability that other authorities will act to confirm the decisions of a given authority. Other authorities . . . are much more likely to confirm the decisions of a challenged authority that controls substantial force" (Tilly 1985, 171). Contractarian narratives of state formation can be seen as the product of successful legitimation. Claessen and Skalnik (1978) documents the effort of the Carolingians to provide ideological foundations to their rule. Olson (1993, 568) makes a similar point: "Since history is written by the winners, the origins of ruling dynasties are, of course, conventionally explained in terms of lofty motives rather than by self-interest."

[10] See Hirshleifer (1995), Bates (2001), and Grossman (2002). Hobbes (1651) writes, "In such condition there is no place for industry, because the fruit thereof is uncertain, and consequently . . . no account of time, no arts, no letters, no society, and which is worst of all, continual fear and danger of violent death, and the life of man, solitary, poor, nasty, brutish, and short." See Tilly (1985) and Keeley (1996). Examples of inequality in favor of an elite class that controlled the "guns" and slavery abound in the early-state record (Cohen and Service 1978). "[S]tate formation involved thousands of deaths, and thousands . . . were converted into slaves" (Flannery and Marcus 2014, 365).

[11] See Ardant (1966). Ardant (1971) describes the force behind the English state development: "This facility in collecting taxes was linked . . . to the decidedly important increase

C. *Organizing Question*

1. Extensive Margin of the Essential Functions of the State

Today's stationary bandits provide a useful starting point to study the emergence of essential functions of states (Olson 1993).[12] First, stationary bandits hold a monopoly of violence in a territory, often by eliminating their rivals—war making and state making. Second, because they

of trade." Johnson and Koyama (2014, 8) note, "The different geography of the two countries also explains why internal trade barriers and tolls provided an important source of revenue for local rulers in France; in England, sea transport was always more important than inland transport and this reduced the value of local trade barriers and made it more straightforward for the monarchy to take control of local customs taxes." Ardant (1975) writes, "Taxes against various kinds of rents are also simple to carry out. Production is sufficiently concentrated so that taxes can be levied at that stage which will eventually be passed on to the consumer." Also,

> Great Britain's economic structure provided the foundation for her fiscal capacity by allowing her to give the most important role to the taxation of commercial activities. . . . Customs, Excise, Stamp. . . . Several factors made it inevitable that England have trade, the channels of which were rather easy to keep an eye on, in spite of smuggling: England was an island, her climate practically precluded the production of wine. . . . The financial administration understood, in advance the problems of a turnover tax applied to small business. . . . It would seem better to tax the consumption of storekeepers, small businessmen, artisans, their workers. . . . City life assumed the circulation of foodstuffs and manufactured objects. . . . Products could be taxed in transit, preferably at the point through which they had to pass to enter the cities, especially when cities were still surrounded by walls. . . . One can understand the preference of finance ministers for indirect taxes, but even these taxes faced the same obstacle. When the manufacture of a whole series of products is concentrated in one setting, as it is today, it is possible to arrange verification of production. . . . When there are small scattered enterprises, this solution is impossible. . . . All that remained was to control circulation. . . . However, despite all the advantages that the ruling classes could find in this kind of tax system, it was not sufficient. . . . States could not bypass direct taxation of the largest part of the taxable population. . . . In the seventeenth century the need to find a satisfactory fiscal system was so strong that various European countries resorted to another tax which had nothing to do with the ability to pay—the poll tax. Gone were the delicate problems of evaluating wealth, one merely had to count the human beings in a nation and place the same tax on each head. (Ardant 1975)

[12] Historical documentation contains rich evidence that currently recognized states are self-selected organizations that competed for extraction (Tilly 1985, 172): "Power holders did not undertake those three momentous activities with the intention of creating national states. . . . Nor did they ordinarily foresee that national states would emerge from war making, extraction, and capital accumulation." Tilly (1975, 38–39) illustrates this process: "Most of the European efforts to build states failed. The enormous majority of the political units which were around to bid for autonomy and strength in 1500 disappeared in the next few centuries, smashed or absorbed by other states-in-the-making. The substantial majority of the units which got so far as to acquire a recognizable existence as states during those centuries still disappeared. And of the handful which survived or emerged into the nineteenth century as autonomous states, only a few operated effectively . . . [O]nly the positive cases are well-documented." Flannery and Marcus (2014, 474) write, "[Competition between states] produces winners and losers. We flock to the winners like paparazzi, forgetting that the competition itself was the real engine of change."

hold a stable monopoly of violence, stationary bandits can sustain credible commitments of tax output to finance their operations—extraction. Finally, through their taxes, stationary bandits are a (partial) residual claimant of economic activity in their territory. Thus, it is in their interest to protect the property of those who produce—protection. Taxation of production, stationary bandits, and protection are thus closely related.

2. Extensive Margin and Population Welfare

A stationary bandit may increase GDP if they create more value added through the effect of their protection on investment than they destroy through the disincentives induced by their taxes. Their effect on GDP thus depends on the counterfactual insecurity of property rights and the distortions their tax rate generates. Yet even if a stationary bandit may increase GDP, they may expropriate the surplus away.

3. Intensive Margin

If taxing output is difficult, a stationary bandit can develop systems of direct taxation and taxes on consumption to capture the economic surplus in circulation. To support the collection of those taxes, they can create a fiscal administration, and to promote economic exchange (and thus tax revenue), they can hold a judicial administration.

4. Organizing Question

When do stationary bandits emerge? Does the population benefit on net? And when do they create fiscal and legal "capacity"? I next present a simple model.

D. Simple Model

A simple model is derived in appendix section A (available online). This section presents the model and its implications in words. In a production economy, workers produce output. In a consumption economy, households use labor income from production to invest and to consume. Roving bandits regularly expropriate output or wealth. An armed actor can use brute force to form a monopoly of brute force in either economy. In that case, he can design a credible taxation plan. In a production economy, he can tax output and labor (working permits). In a consumption economy, he can tax returns on investments. Households can evade taxes at some cost, but an armed actor can create an administration to increase such cost, as in Besley and Persson (2009). The armed actor maximizes a weighted average of his own revenues from expropriation and the population welfare.

In general, this produces the following testable implications. First, monopolies of brute force are more likely to form in a production economy when the output price is high. This effect is stronger if output cannot be concealed and in locations where it can be shipped. Second, monopolies of brute force are more likely to form in consumption economies when valuable wealth is in circulation, especially if output in the production economy can be concealed. Third, the more the armed actor controlling the monopoly of brute force values the welfare of his population, the more the monopoly of brute force benefits the population. Fourth, in a consumption economy, a fiscal administration that curbs tax evasion can increase revenues from expropriation, especially when wealth in circulation is high.

III. Empirical Strategy

A. Empirical Setting

In 1998, following an attempted coup by the Rassemblement Congolais pour la Démocratie (RCD), RCD divisions, multiple regional militias known as the Mayi-Mayi, and the Forces de Libération du Rwanda (FDLR, a Hutu militia) gained control over the eastern half of the country.[13] Although their interests were originally political, economic incentives quickly became central in the Second Congo War.

As a result of a peace agreement signed in Sun City (South Africa) in 2003, the RCD and major self-defense groups agreed to vacate the eastern DRC and integrate into the newly formed national army (FARDC [Forces Armées de la République Démocratique du Congo]). While some refused to join, individuals originating from these groups who integrated into the FARDC maintained their command networks. This merger further undermined the distinction between armed groups and the state. In 2017, 132 armed groups were active (Stearns and Vogel 2017), controlling up to 95% of the territory in some districts (Radio Okapi 2013). The FARDC controlled valuable areas of gold, timber, cacao, and coffee production and systematically operated protection rackets and raised illicit taxes (Verweijen 2013).[14]

Mineral extraction in the eastern DRC, done by "artisanal miners," is labor intensive. Millions of artisanal miners exploit the minerals today with minimal infrastructure (World Bank 2008). The two dominant

[13] The First Congo War lasted from 1996 to 1997. The Second Congo War, referred to as "The Great African War," involved nine foreign armies and 30 local militias (Nzongola-Ntalaja 2002; Stearns 2011).

[14] See Marchais (2016). Stearns, Verweijen, and Baaz (2013, 50) note, "Patronage networks in the FARDC reinforce the orientation of the army towards revenue-generation rather than defence. . . . Illegal taxation also occurs at roadblocks along main transport routes, and at markets, border posts, harbours, and airports." Among armed groups, the Raia-Mutombokis controlled 95% of the Shabunda territory in 2013, and a total of 30,000 km^2. See Nzongola-Ntalaja (2002), Nest (2011), Nest, Grignon, and Kisangani (2011), Stearns (2011), Verweijen (2013), and Stearns and Vogel (2017).

minerals are coltan and gold. Gold has a higher value-to-weight ratio, and daily production is small and uncertain. Owing to the poor road infrastructure, coltan output is shipped by plane until it reaches global markets. Artisanal miners are partial residual claimants. Local militias, foreign armed actors, and criminal units in the FARDC regularly provide security and tax.

At the start of 2000, Sony announced the release of a new video-game console for Christmas, Playstation II, which used coltan as a key input. Columbite-tantalite-processing firms began a rush for coltan in the DRC, pushing the US price from $90 to $590 per kilogram, before it collapsed during the Christmas season upon the failure of the Playstation II. Then, following the global recession, investors began a rush to gold as a safe haven. The US price of gold rose sharply, especially after 2006, reaching levels in 2012 of up to 6 times the preshock levels. Figure 1 shows the prices of gold and coltan through these shocks.[15]

Rural eastern DRC is partitioned into municipalities. Each municipality has exactly one village, in which households are located—henceforth referred to as the "support village." Mineral deposits, each located in one municipality, were discovered in the twentieth century, prior to the study period.[16] Mineral deposits are often far from their support village. The average distance of a mining site to its support village in this paper's sample is 10 hours of walking (the maximum is 180).

Minerals extracted at the mine often circulate through the support village. For low-value-to-weight minerals (coltan), transporters carry bags of up to 75 kg by foot from the mine to the support village every day. For gold, the supply chain is more difficult to track, because miners and carriers systematically conceal gold output. Reflecting this pattern, gold is known as the "immaterial mineral." World Bank (2008) suggests that $125 million worth of gold is exported yearly.[17]

B. Data Collection Strategy and Data

A team of 10 surveyors reconstructed a yearly historical data set on 239 support villages and their corresponding 411 mining sites in Sud Kivu

[15] See United Nations Security Council (2001), Nest (2011), and Stearns (2011). The DRC's global gold output share is 0.08%. For coltan, it went from 0% in 1997 to 12% in 2000 and 20% in 2010. A second shock to the price of coltan hit in 2011 (US Geological Survey 2016).

[16] Figure F.1 (figs. A.1, A.2, and F.1–F.20 are available online) represents the typical municipality graphically.

[17] While a coltan miner might produce up to 50 kg of coltan per day, a typical day of work mining gold yields between 0.1 and 10 g of gold output. In the absence of prohibitively costly X-ray equipment, regularly used in other countries, the miners conceal gold output (Geenen 2013). Miners often digest the output in order to sell it in a major urban center. The average world price per kilogram of gold in the period was $17,404, compared to $136 for coltan. Daily production per worker is approximately 20 kg for coltan and between 1 and 10 g for gold. See de Failly (2001), World Bank (2008), Nest (2011), and Geenen (2013).

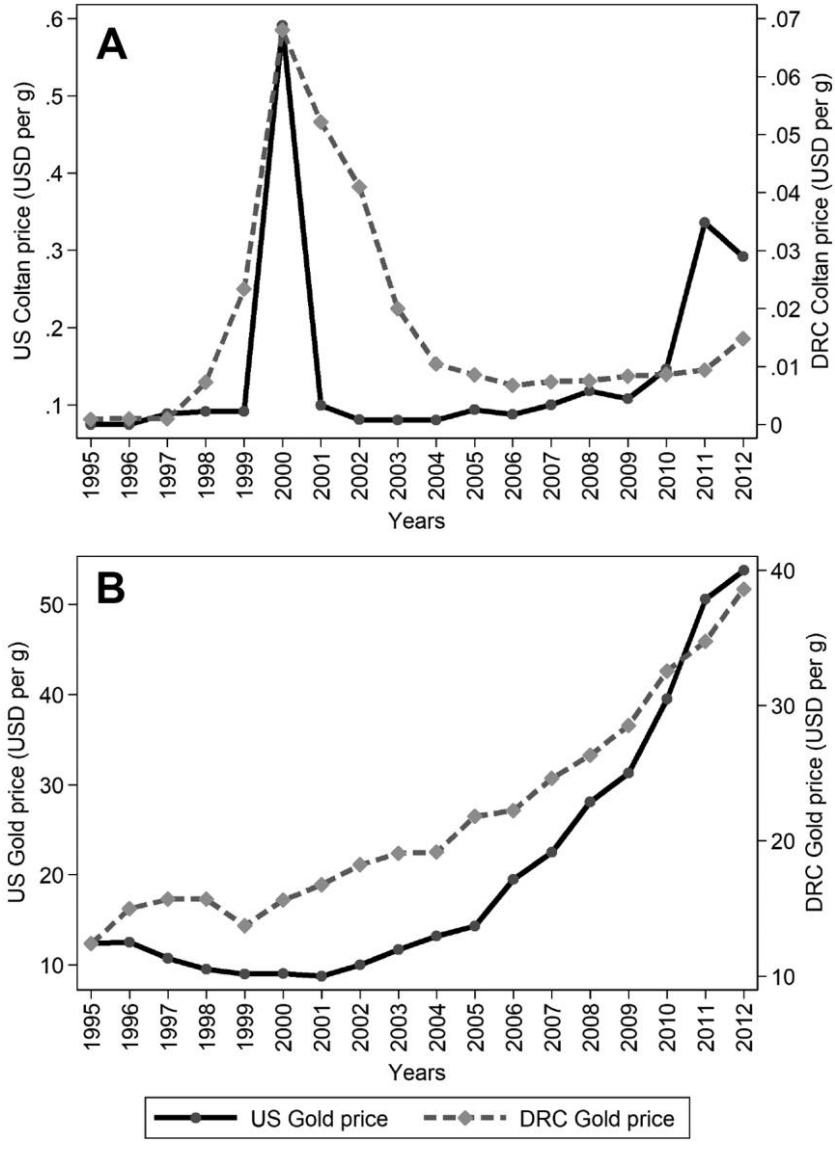

FIG. 1.—This figure plots the yearly average price of coltan (*A*) and gold (*B*), in US dollars (USD) per gram, in the United States and the DRC. US prices are taken from US Geological Survey (2016), and DRC prices are from this study's survey and are collected through recall. The price of gold in the DRC is at times higher than the US price, reflecting measurement error from recall data. A color version is available online.

and Nord Kivu, based on recall.[18] Reconstructing a municipality's history based on recall is subject to three challenges: first, classic measurement error due to imperfect recall of the magnitudes of events; second, classic measurement error due to imperfect recall of the dates at which events took place; third, reporting bias for sensitive information. To address these challenges, I used established methods in recall studies from eyewitnesses and, based on 3 months of piloting, tailored them to the cultural context.

In each support village, where municipality experts live, the surveyors trained "history specialists" to consolidate, during one week, a municipality history data set. Each day, the surveyors monitored the specialists' work and retrained them to improve accuracy in the data. In the course of the week in each support village, the surveyors administered private interviews in six (Sud Kivu villages) to eight (Nord Kivu villages) randomly selected households. In each household, they discussed the municipality's and household's history with all available household members, and after randomly selecting a respondent, they discussed the respondent's individual history in private. During the week, they also prepared an in-depth qualitative report about the municipality's history based on conversations with selected individuals. Finally, in each support village, the surveyors held a day-long meeting with the history specialists and contrasted their own data to the data gathered by the history specialists during the week. By the time this meeting was held, the surveyors were able to detect and correct reporting biases among the history specialists. The data from this meeting constitute the main source of data for this paper.[19] Figure 2 presents the sample.

[18] In Sud Kivu, I sampled all coltan municipalities. Since gold municipalities are more numerous, I selected a random sample of gold municipalities within each administrative division (*territoire*). I also sampled 20 pure agricultural municipalities, matching on all geographic characteristics known ex ante within administrative division—I minimized the Mahalanobis metric between mining and agricultural municipalities. I identified municipalities endowed with minerals in existing data sets (International Peace Information Service 2009; Référentiel Géographique Commun 2010*a*, 2010*b*) and completed the existing data sets by conducting prospections in each *territoire* before sampling. In Nord Kivu, because of the importance of other economic activities, unlike in Sud Kivu, I sampled all municipalities with mining activity or any other meaningful economic activity (banana, coffee, cacao, beans).

[19] The history specialists were easy to identify and came from two groups: (1) individuals who had a long involvement in the mining sector and (2) village elders, who were easy to identify owing to the tradition of oral history. Data collection activities took place from July 2012 through June 2013 in Sud Kivu and from February through October 2015 in Nord Kivu. Appendix sec. B describes each variable in detail. Appendix sec. C describes this methodology, the contextual factors that reduced recall error, and further design improvements to reduce the likelihood of such errors, and replicates and discusses the results with alternative data sources. Finally, figs. F.2 and F.3 provide a validation test for the demand shocks. Figure F.2 shows nighttime lights. Zonal statistics show that in the year 2000, the provincial capital of North Kivu (and Rwanda) lightens, reflecting the increase in economic activity in the coltan region. Figure F.3 shows the average occupational choice.

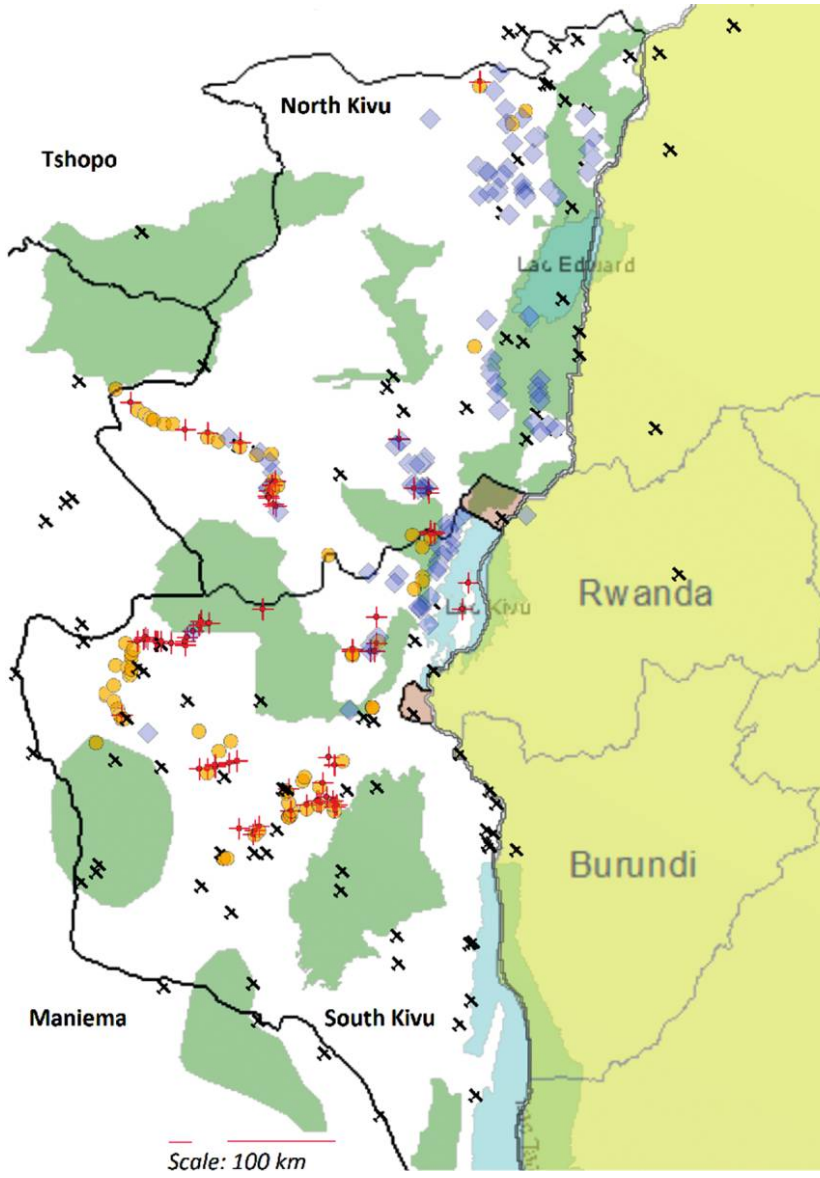

FIG. 2.—Locations of the support villages in the sample. Support villages with at least one coltan mine are marked with a cross. Support villages with at least one gold mine are marked with a disk. Support villages with neither gold nor coltan mines are marked with a diamond. The economy of such municipalities is based on cash crops—coffee, cacao, beans—less prevalent minerals in the sample (cassiterite and tungsten), or, for a small sample, subsistence agriculture (Kalehe). Airplanes indicate local airstrips.

C. Econometric Strategy

With the retrospective local output price data at hand, I could use all years for which I have the full sample (1995–2013) and include municipalities that have coltan, gold, or other profitable endowments (cassiterite, tungsten, coffee, beans, and cacao), as well as the matched sample of agriculture municipalities, in the following linear probability model, estimated through ordinary least squares (OLS):

$$Y_{jt} = \beta_t + \alpha_j + \gamma_c C_j p_{c,t} + \gamma_g G_j p_{g,t} + \varepsilon_{jt},$$

where $Y_{jt} \in \{0, 1\}$ is a dummy corresponding to output taxation, stationary bandit, and security services (extensive margin) or more sophisticated taxes and creation of fiscal and judicial administrations (intensive margin) in municipality j in year t. The terms α_j and β_t are municipality j and year t fixed effects, C_j (G_j) $\in \{0, 1\}$ indicates whether municipality j is endowed with coltan (gold), and $p_{c,t}$ ($p_{g,t}$) is the logarithm of the local price of coltan (gold) at year t.[20]

However, the local price of mineral output is (quite plausibly) endogenous to the behavior of armed actors, and thus the exogeneity assumption $E[\varepsilon_{jt} | G_j p_{g,t}, C_j p_{c,t}] = 0$ is almost surely violated. I can, however, use the price of minerals in the United States, as long as they are unaffected by the behavior of armed actors in the corresponding DRC locations. First, the DRC share of gold supply is insignificant, and thus its effect on the world price is negligible (US Geological Survey 2016). Thus, the exogeneity assumption can hold reasonably if, instead of local gold prices, I use US prices. Furthermore, the price of gold rises sharply after 2006 as a result of speculation in financial markets. Second, the exact share of Congolese coltan in world supply is unknown (Nest 2011), although it hardly surpasses 20%. More importantly, the price fluctuation in the year 2000 arises from very well-documented speculation in the industry (United Nations Security Council 2001; Stearns 2011). Failing to be met by industrial supply from the major supplier in Australia, demand rushed to the spot market for coltan upon the announcement of Playstation II.[21] I thus run the following reduced-form specification:

$$Y_{jt} = \beta_t + \alpha_j + \gamma_c C_j p_{c,t}^{US} + \gamma_g G_j p_{g,t}^{US} + \varepsilon_{jt}, \quad (1)$$

where $p_{c,t}^{US}$ ($p_{g,t}^{US}$) is the logarithm of the US price of coltan (gold) at year t. The main results of the paper are based on this reduced-form specification for two reasons. First, local estimates of output prices, constructed

[20] US Geological Survey (2016). Table F.1 (tables F.1–F.18 are available online) provides descriptive statistics.

[21] See (Nest 2011,15): "Ordinary Congolese [did not] know that what was ostensibly tin mining also produced quantities of an obscure mineral."

through recall, are extremely unreliable. Figure 1 presents the survey estimates of the local price data, and appendix section E presents a 2SLS (two-stage least squares) estimation of the effect of local price on armed-actor behavior, alongside 12 other robustness checks. The coefficient magnitudes are significantly larger (and significant) in the 2SLS. Second, the coltan results are unchanged when I restrict the analysis to 1999–2001, the only interval in which the US coltan price is credibly exogenous (shown in the supplementary material). As a result, the coefficients in the main specification indicate the effect of a 1 percentage point increase in the US price on the probability that Y_{jt} occurs.

In all core analyses, I tackle two concerns about standard error estimation in panel data. First, the mines connected to the same support village could have correlated shocks. Thus, for the analysis of mines, I average the mining site × year observations at the municipality × year level and remove redundant observations (unweighted collapse), and for the analysis of support villages, I use the support village × year observations but collapse the mining treatment variables at the level of the municipality × year. Second, the error term and the price might be autocorrelated. Thus, I cluster the standard errors at the level of the municipality. Furthermore, to shield against multiple-comparison problems, I also report the results using mean indices, the mean of the corresponding outcomes normalized to mean zero and standard deviation of one.

IV. Emergence of the Essential Functions of a State

A. Conflict: Violent Attacks

Figure 3 shows the proportion of municipalities attacked through the years. The share of coltan municipalities that are attacked rises by 27.1% in the year 2000, against 4.8% for gold municipalities. Column 1 of table 1 supports the results econometrically.[22] This result is consistent with a "rapacity effect" (Dube and Vargas 2013), indicating that armed actors fight for control over valuable resources. This might lead one to conjecture that stealing gold is hard and thus that revenue from mining gold deters participation in violent appropriation activities.

However, the behavior of armed actors is often more complex than outright theft. As described in the next section, the shock leads to the emergence of taxation on mining production, protection of mining workers and their families, and ultimately to "stationary bandits," often a profitable strategy to extract revenue that embodies the essential functions of a state.

[22] Table F.2 shows additional robustness for the analysis of attacks at the municipality.

FIG. 3.—Conflict: violent attacks. This figure presents the proportion of municipalities that are subject to an attack through the years in the sample. The solid and dashed time-series lines, respectively, indicate the proportions for coltan locations and gold locations. The dotted time-series line marks the proportion of locations endowed with any other resource (including the matched subsistence agriculture sample of Kalehe). A location that is a mine is coded as coltan if it is endowed with coltan, and similarly for gold. A location that is a mine is coded as "other" if the mines in its municipality have neither gold nor coltan. A location that is a support village is coded as coltan if at least one mine in its municipality has coltan, and similarly for gold. A location that is a support village is coded as "other" if its municipality has neither gold nor coltan mines. The proportions are expressed in deviations from 1999 levels. The solid vertical line indicates 1999, the year preceding the major coltan shock. The dashed vertical line indicates 2005, the year preceding the completion of the postwar transition of military actors. The dotted vertical line indicates 2010, the year preceding the second, smaller coltan shock (which, as seen from fig. 1, had a negligible effect on local prices). A color version is available online.

B. *Explaining Output Taxation, Stationary Bandits, and Protection*

There are two major types of taxation related to mineral extraction. The first is taxes on output, typically through customs: stationary bandits block the road through which output is transported, inspect the output on transporters, and charge a tax proportional to the output. Customs taxation is inherent to taxation of voluminous minerals. In gold-mining sites, a customs tax would face systematic tax evasion and is thus rarely observed. The

TABLE 1
EXPLAINING THE RISE OF TAXES ON PRODUCTION, STATIONARY BANDITS, AND PROTECTION

		Mine					Village		
Variables	Municipality Attacked (1)	Customs Tax (2)	Entry Fees (3)	Stationary Bandit (4)	Security Service (5)	Extensive-Margin Index (6)	Stationary Bandit (7)	Security Service (8)	Extensive-Margin Index (9)
Coltan$_j$× p_{ct}	.15***	.06**	.01	.07***	.06**	.16***	.04	.02	.07
	(.03)	(.02)	(.02)	(.03)	(.02)	(.06)	(.03)	(.02)	(.05)
Gold$_j$× p_{gt}	−.02	−.04	.04*	.05	.05	.10	.12***	.15***	.33***
	(.03)	(.02)	(.03)	(.04)	(.04)	(.07)	(.04)	(.04)	(.08)
Observations	4,158	4,046	4,052	3,991	4,032	3,903	4,302	4,302	4,302
R^2	.39	.59	.69	.60	.62	.65	.50	.42	.50

NOTE.—Standard errors are in parentheses. This table presents the results from specification 1, using as dependent variables the extensive-margin outcomes. Column 1 uses as dependent variable whether the municipality was attacked in a given year (in any of its mines or its support village, by any actor). Columns 2–6 show the outcomes at the production site (mine), and cols. 7–9 those at the support village corresponding to the mine. Column 2 uses a dummy indicating whether an armed actor imposed customs taxation on mining output at the exit of the mine (enforced through a roadblock). Column 3 uses a dummy indicating whether an armed actor imposed an entry fee to work at the mine (enforced through a roadblock). Column 4 uses a dummy indicating whether an armed actor had established a monopoly of violence at the mine. Column 5 uses a dummy indicating whether an armed actor provided a security service at the mine. Column 6 uses the extensive-margin index at the mine as dependent variable. The extensive-margin index at the mine is constructed as the mean of customs taxation, entry fees, stationary bandit, and security service, normalized to mean zero and standard deviation of one. Column 7 uses instead a dummy indicating whether an armed actor had established a monopoly of violence at the support village corresponding to the mine. Column 8 uses a dummy indicating whether an armed actor provided a security service at the support village corresponding to the mine. Column 9 uses the extensive-margin index at the support village as dependent variable. The extensive-margin index at the support village is constructed as the mean of stationary bandit and security service at the village, normalized to mean zero and standard deviation of one. There are 239 municipalities in the sample, broken down into 239 support villages and their 411 corresponding mining sites. The mine × year–level data are collapsed at the municipality-year level. All columns include year- and municipality-level fixed effects. Standard errors are clustered at the level of the municipality to account for autocorrelation in the dependent variable, the mineral endowments (which are time invariant), and the mineral price. Appendix sec. E describes 13 robustness checks. The results are presented in tables F.2, F.5, and F.6 and figs. F.4–F.8. Table F.7 and fig. F.9 show the effect of the price shocks on the composition of stationary bandits. Table F.8 shows the results excluding the FARDC, and table F.9 shows the results including only the FARDC.

* $p < .1$.
** $p < .05$.
*** $p < .01$.

second is entry fees (also called working permits or visas). They are more prevalent in gold sites, where customs taxation is impossible.[23]

1. Extensive Margin

Table 1 shows the results from specification 1. Column 2 uses a dummy indicating whether an armed actor imposed customs taxation on mining output at the exit of the mine. Column 3 uses a dummy indicating whether an armed actor imposed an entry fee to work at the mine. Column 4 uses a dummy indicating whether an armed actor had established a monopoly of violence at the mine. Column 5 uses a dummy indicating whether an armed actor provided a security service at the mine. Column 6 uses the normalized mean index at the mine.[24] Columns 7–9 show stationary-bandit activity at the corresponding support village. Column 7 shows whether a stationary bandit was installed and column 8 whether an armed actor provided security. Column 9 uses the normalized mean index at the support village.[25]

While the coltan price is associated with the emergence of the essential functions of a state based on customs taxation, stationary bandits, and protection at production sites, the gold price leads armed actors to capture benefits through other means. Instead, the gold price leads to the emergence of daily mining-work visas at production sites and stationary bandits and protection in the support villages. Doubling the US (local) coltan price increases the mine-level extensive-margin index by 0.16 (0.17) standard deviations. Doubling the US (local) gold price increases it by 0.33 (0.64) standard deviations at the village (the effect of the local price is estimated via 2SLS).[26]

Figure 4*A* shows that, before the shock, coltan areas and the rest follow parallel upward trends, reflecting well-known timing of the First and Second Congo Wars. The coltan shock leads the extensive-margin outcomes

[23] A Wilcoxon-Mann-Whitney test shows that stationary bandits set up customs taxes in coltan-mining sites more frequently than in gold sites and labor fees less frequently. Table F.1 presents the descriptive statistics for mining sites that have coltan (but not gold) and mining sites that have gold (but not coltan). Armed actors also may request output quotas in kind, although these are less regularly enforced and more difficult to measure. The survey in most areas excluded other forms of output taxation.

[24] The extensive-margin index at the mine is constructed as the mean of customs taxation, entry fees, stationary bandit, and security service, normalized to mean zero and standard deviation of one. Removing entry fees from the index, not based on output, significantly increases the coefficient estimate.

[25] This index is constructed as the mean of village stationary bandit and security, demeaned, in units of standard deviations.

[26] Appendix sec. E describes 13 robustness checks, including the 2SLS estimation for the effect of the local price. The results, presented in tables F.5 and F.6 and figs. F.4–F.8, are robust to the large majority of these checks.

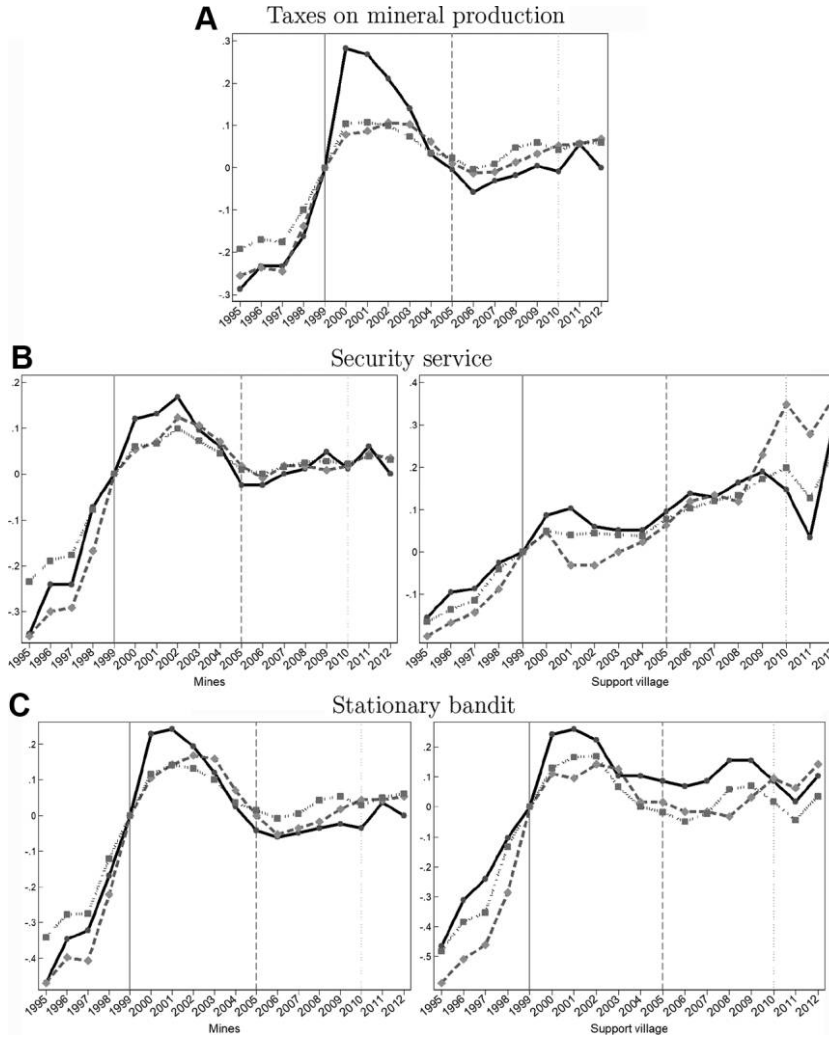

FIG. 4.—Explaining the rise of taxes on production, stationary bandits, and protection. This figure presents the extensive margin of the essential functions of a state: taxation, monopoly of violence, and protection. *A*, *B*, and *C* present, respectively, the proportion of sites where stable taxation exists, where a bandit holds a monopoly of violence, and where an armed actor provides security. In *B* and *C*, the left-hand graph presents the outcomes at the mine, and the right-hand graph presents the outcomes at the support village. The solid and dashed time-series lines indicate, respectively, the proportions for coltan sites and gold sites. The dotted time-series line marks the proportion of locations endowed with any other resource (including the matched subsistence agriculture sample of Kalehe). A mine is coded as coltan if it is endowed with coltan, and similarly for gold. A mine is coded as "other" if the mines in its municipality have neither gold nor coltan. A support village is coded as coltan if at least one mine in its municipality has coltan, and similarly for gold. A support village is coded as "other" if its municipality has neither gold nor coltan mines. The proportions are expressed in deviations from their 1999 levels. The solid vertical line indicates 1999, the year preceding the major coltan shock. The dashed vertical line indicates 2005, the year preceding the completion of the postwar transition of military actors. The dotted vertical line indicates 2010, the year preceding the second, smaller coltan shock (which, as seen from fig. 1, had a negligible effect on local prices). A color version is available online.

at coltan mines to diverge from the rest, and it takes them 3–6 years to recover to the level of the other areas.[27]

These results reflect a consistent underlying tendency in the data. Figures F.4 and F.5 repeat the estimation procedure for each of the 116 possible year intervals for the extensive-margin index. The results replicate in the large majority of year intervals.[28]

2. Heterogeneous Effects by Trade Infrastructure

The extensive-margin effect for coltan, but not for gold, is concentrated in mines (and support villages) that are near an airstrip—through which coltan is usually exported (because of the poor road infrastructure and the low value-to-weight ratio).[29]

C. *Who Are the Stationary Bandits?*

Even as the boundaries between them are porous, four types of armed actors populate the sample. First, there are village self-defense militias. These are formed by villagers themselves to protect the population or obtain

[27] A note on parallel trends: a formal test determined that the assumption of parallel trends can be retained. To do this, I constructed a dummy indicating after 1999 (POST) and a dummy indicating whether the municipality has coltan. I then ran the following specification: $Y_{jt} = \alpha + \beta_1 \text{POST}_t + \beta_2 \text{TREAT}_i + \beta_3 \text{POST}_t \times \text{TREAT}_i + \beta_4 \text{POST}_t \times \text{TREAT}_i \times t$. The coefficient on β_3 is unaffected by the inclusion of $\text{POST}_t \times \text{TREAT}_i \times t$, the coefficient on β_4 is negative, and β_3 is 2,000 times as large as β_4. Similarly, col. 4 of tables F.5 and F.6 shows that no anticipatory effects, a necessary condition for the parallel-trends assumption, hold: including leads leaves the contemporaneous coefficient unaffected (and the leads' coefficients have a negative sign, significant for coltan). A note on persistence: existing descriptions of the sector (United Nations Security Council 2001) and data on local traders' retrospective expectations of price levels, which were collected in this study, suggest that local traders expected the coltan price shock to be permanent and its fall to be temporary. Thus, they stockpiled coltan years after the global price shock. This accounts for the sustained price. Additional analysis suggests that the persistence of the local price cannot explain why such functions persist. See United Nations Security Council (2001) and table F.3.

[28] The figures show that $\widehat{\gamma_C}$ the estimated coefficient on $C_j p_{c,t}^{\text{US}}$ in a regression of mine-level data collapsed at the municipality/year level, is positive in 70% of the year intervals; $\widehat{\gamma_G}$, the corresponding estimated coefficient on $C_j p_{g,t}^{\text{US}}$ in a regression of mine-level data collapsed at the support village/year level, is also positive in 70% of the intervals. The coefficient is strengthened when I include the interaction with distance to airports, indicating that the effect is strong for mines close to airstrips. In contrast, $\widehat{\gamma_G}$, the estimated coefficient on $G_j p_{c,t}^{\text{US}}$ in the regression of mine-level data collapsed at the municipality/year level, is zero or negative in 69% of the year intervals, and no positive coefficient is distinguishable from zero.

[29] Let $D_j^a \in \{0, 1\}$ indicate whether the distance of municipality j to the closest airport is above the median. When I include $C_j p_{c,t}^{\text{US}} D_j^a$ and $p_{c,t}^{\text{US}} D_j^a$, the coefficient on $C_j p_{c,t}^{\text{US}}$ captures the marginal effect of the coltan price on municipalities that are close to an airport. Table F.4 presents the results using a dummy for whether distance to the closest airport is above the median. The effect of the coltan price shock is concentrated near airports. In contrast, the effect of the gold price shock at the support villages is equally strong close and far from airports. Results using continuous distance to airports are identical.

revenge. Second, there are regional militias, whose origins as village militias are trumped by their larger scale. They often extend control to other locations, where they often have weak ties to the population. Third, other armed actors represent the interests of foreign ethnic groups, often semi-autonomous units of large organizations (hereafter "external actors").[30]

Finally, there is the FARDC. The FARDC, created in 2003 by a merger of the belligerents of the Second Congo War (Baaz and Verweijen 2013), is infiltrated by organized-crime networks who generate illicit revenue systematically. Despite its mandate to protect the population, FARDC actors operate mafia-style protection rackets comparable to those of other armed actors, extort, sell protection, and raise illegal taxes, and its members establish themselves privately as stationary bandits (Verweijen 2013). Members of the army, so-called soldiers without an army (Verweijen 2018), are former armed-group members who kept their structures of command but "upgraded" to the FARDC to improve their control over illegal trade, as it offered an umbrella for organized crime (Verweijen 2015). Individual armed actors of the FARDC took control of the illicit taxation in gold areas as well as the illicit trade of timber and coffee (Stearns 2011; Verweijen 2013). Even as the FARDC also performs some other functions of the Congolese state (territorial integrity), it can be understood as permeated by organized crime, with weak central command. The taxes collected by the FARDC, illegally, are requested by individuals privately acting as stationary bandits.

Table 2 provides support for this classification. Of 593 stationary-bandit episodes at the support village, 17% are attributed to regional militias, 23% to village militias, 35% to external armed actors, and 26% to the FARDC. The stationary bandits differ in their composition and acceptance (panel A). First, militias have closer ties to the population. On average, 55% of village militia members are coethnic with the village chief, against 30% for regional militias and 16% and 18%, respectively, for external groups and the FARDC. Second, village militias and the FARDC are seen as more legitimate. Referring to each stationary bandit who controlled their village, households reported in the household survey that the stationary bandit was seen as legitimate in their view in 29% of episodes when the stationary bandit was from a village militia, against 70% for the FARDC, and 21% and 17% for regional militias and external armed actors, respectively. Third, external armed actors account for a larger share of attacks against the population (pillage and sanctioning), and attacks of a more violent nature (panel B). Indeed, 64% of the 834 support village attacks recorded in

[30] See Marchais (2016): "The particularity of [Mayi-Mayi and Raia Mutomboki] was the fact that—at least in their initial stages, they were supported and mediated by local structures of authority and social organization and enjoyed popular support, in sharp contrast to more 'top down' insurgencies such as the CNDP and M23." External actors include the Tutsi-led RCD, the CNDP (Congrès national pour la défense du peuple), the AFDL, M23, the PARECO (Patriotes Résistants Congolais), and the Hutu-led FDLR/Interahamwe.

TABLE 2
WHO ARE THE STATIONARY BANDITS?

	External groups	Army (FARDC)	Regional Militias	Village Militias
	A. Stationary Bandits			
Support village (episodes)	206	153	98	136
Coethnicity with chief (% members)	16	18	30	55
Seen as legitimate (% episodes)	17	70	21	29
	B. Armed-Actor Attacks			
No. of attacks	535	38	259	2
Type (%):				
Conquest	36	53	54	0
Sanction	29	32	44	0
Pillage	72	39	49	50
Crimes (%):				
Sexual violence	59	43	36	0
Kidnapping	56	14	34	0
Death	61	40	50	50
	C. Stationary Bandits' Actions (% years)			
Mine:				
Extensive margin:				
Customs taxation	46	33	66	22
Entry fees	33	38	55	47
Security service	62	69	62	77
Support village:				
Extensive margin:				
Security service	29	72	28	59
Intensive margin:				
Poll tax	80	46	82	85
Toll tax	52	33	38	43
Sales tax	49	23	47	45
Mill tax	16	10	10	31
Fiscal administration	68	16	68	47
Judicial administration	70	28	69	49

NOTE.—This table presents the classification of stationary bandits into village militias, regional militias, the Congolese army (FARDC), and external organizations. Panel A decomposes stationary-bandit episodes that are observed at the support village in this survey and shows key characteristics linked to the origin and acceptance of the stationary bandit. The percentage of members coethnic with chief is calculated by gathering the ethnicity of the top five members of the stationary-bandit unit at the village. The row "Seen as legitimate" shows the average household-level response, extracted in household interviews about each corresponding stationary-bandit episode in the village, as the answer to the question, Did you consider that the stationary bandit was legitimate in your view? Both coethnicity and "perception of legitimacy" were collected only in the second phase of the survey (only in the 106 support villages of Nord Kivu). Panel B shows the attacks recorded in the survey, by type of armed actor. These attacks are mostly perpetrated by armed actors who are not stationary bandits in the location where the attack takes place, but they may be stationary bandits in another location. Panel C shows the extensive- and intensive-margin actions of each stationary-bandit type. Source: this paper's survey, support-village-level data. The classification is constructed as follows. Village militias emerge in the municipality as popular mobilizations. Regional militias are popular mobilizations that emerge in the region but not in a municipality. Regional militias include many former village militias, including Mayi-Mayi factions—Janvier, Kaganga, Kasingie, Kifuafua, Padiri, Lafontaine, Lulwako, Mudohu, Katalayi, Mze, Nyakiliba, Sim, Samy, Surambaya—Raia Mutomboki (all factions), Nyatura, Batiri, Katuku, and Mbaire. External organizations are not from the area and are most often "foreign" ethnic groups. External organizations include the Tutsi-dominated RCD, CNDP, AFDL, and M23 and the Hutu-dominated FDLR (including FDLR Tanganyika), Interahamwe, and PARECO, as well as other groups that are neither Tutsi nor Hutu dominated but are of foreign origin, such as the ADF-NALU (Allied Democratic Forces–National Army for the Liberation of Uganda).

the survey were perpetrated by external armed actors, and 72% of their attacks included pillage, 59% sexual violence, 56% kidnapping, and 61% death. In contrast, militias and the FARDC account, respectively, for 31% and 5% of attacks, which were significantly less gruesome.

The stationary bandits also differ in the essential functions that they develop (panel C). First, all stationary bandits, irrespective of their motives, engage in illicit taxation of production. Regional militias and external groups use customs taxes more frequently than entry fees (respectively, 66% vs. 55% and 46% vs. 33%), whereas the FARDC and village militias do the reverse (respectively, 33% vs. 38% and 22% vs. 47%). Second, the FARDC provides security at the mines in 69% of years; regional and village militias, created for protection, 62% and 77%, respectively; and external armed actors 62%.

Militias and external groups respond to the coltan price. Armed actors affiliated to the FARDC, absent during the coltan shock and more numerous during the gold shock, respond to the gold price. Indeed, excluding the FARDC strengthens the effect of the coltan price and weakens the effect of the gold price.[31] The armed actors known to be the strongest (regional militias, external Tutsi-led forces, and the FARDC) sort into the most profitable villages/mines, evidence that contestation governs the allocation of stationary bandits to places. Appendix section A provides a formal derivation for why sorting can occur as a result of contestation.

V. Essential Functions of a State and Household Welfare

A. *Measuring the Value of Living in a Location for Households*

I use the data from the random sample of households interviewed at each support village to measure household welfare. First, I construct a savings index, applying principal component analysis for categorical data to the household's yearly cattle acquisitions. Second, I use the log (+1) of yearly weddings celebrated in the village—a costly and prestigious investment in a bride-price society that contains implausible outliers. Third, similarly, I use the log (+1) of the number of migrants into the village to elicit changes in the relative desirability of living in a village. Cattle, weddings, and immigrants, rare events, are easy to recall using the time cues. Fourth, I combine them into a welfare index, using principal component analysis, also normalized.

I address three issues specific to household panel data. First, changes in mineral prices may lead households to migrate. Thus, to isolate changes in household welfare from changes in the (potentially endogenous) composition of households, I include only households who had settled in the

[31] Table F.7 and fig. F.9 show composition. Tables F.8 and F.9 exclude, respectively, the FARDC and the rest. The RCD (external) created their own village militias. This fully accounts for the effect of the coltan price on village militias.

support village before 2000. I use changes in the welfare of these households over time.[32] Second, households in a support village may have common year shocks. I thus aggregate the data of household × year observations into support village × year means. Third, household outcomes are likely autocorrelated. I thus cluster standard errors at the level of the support village.

The analysis examines the effect on welfare of having a stationary bandit of a particular type. I pool regional and village militias into militias because village militias are a small sample (112 events). The effects for militias shown in the next section are driven by regional militias, and the coefficients for village militias are insignificant, reflecting that they are weaker in providing protection and that some local militias (called "Local Defense") were satellite groups created by external organizations.

B. Heterogeneous Effects of the Mineral Price Shocks

Let SB_{jt} indicate whether a stationary bandit is present in support village j at year t. Let External_{jt}, Militia_{jt}, and Army_{jt}, respectively, indicate whether a stationary bandit affiliated to an external organization, a (village or regional) militia, or the FARDC is present in the village—if $\text{SB}_{jt} = 1$, then $\text{External}_{jt} + \text{Militia}_{jt} + \text{Army}_{jt} = 1$.[33] I include the terms $C_j \times p_{c,t}^{\text{US}} \times \text{SB}_{jt}$, $C_j \times p_{c,t}^{\text{US}} \times \text{SB}_{jt} \times \text{Militia}_{jt}$, and $C_j \times p_{c,t}^{\text{US}} \times \text{SB}_{jt} \times \text{Army}_{jt}$ in specification 1, using the welfare outcomes as dependent variables. The coefficient on $C_j \times p_{c,t}^{\text{US}}$ estimates the effect of the coltan price in support villages without a stationary bandit. The coefficient on $C_j \times p_{c,t}^{\text{US}} \times \text{SB}_{jt}$ estimates its additional effect in support villages that have a stationary bandit affiliated to an external organization. The coefficients on $C_j \times p_{c,t}^{\text{US}} \times \text{SB}_{jt} \times \text{Militia}_{jt}$ and $C_j \times p_{c,t}^{\text{US}} \times \text{SB}_{jt} \times \text{Army}_{jt}$ estimate the additional effects of the price due to having a stationary bandit affiliated to, respectively, a militia and the FARDC, compared to its effect when the stationary bandit is from an external organization.[34]

[32] Results are unchanged when I include only respondents who were born in the support village or only the years in which the respondent lived in the support village.

[33] First, as a result of measurement error, there exist some cases when SB = 0 but Militia = 1 (120 out of 2,283). Second, Militia, Army, and External can coexist, which happens in limited cases. Third, as a result of measurement error, about 15 out of 2,283 SB episodes are of other types of armed groups. The regression results including and omitting SB from the interaction terms are very similar. This applies to tables 3 and 4.

[34] It follows from sec. II.D that militia- and FARDC-affiliated stationary bandits should have a more positive (or less negative) effect on welfare than stationary bandits affiliated with an external organization. Thus, following sec. II.D, I estimate the marginal effect on welfare of a militia stationary bandit, over and above the effect of an external stationary bandit. It does not follows from sec. II.D, however, that militias have a positive effect altogether on welfare. To estimate that, one would need to include in the specification the terms $C_j \times p_{c,t}^{\text{US}}$, $C_j \times p_{c,t}^{\text{US}} \times \text{External}_{jt}$, $C_j \times p_{c,t}^{\text{US}} \times \text{Militia}_{jt}$, $C_j \times p_{c,t}^{\text{US}} \times \text{Army}_{jt}$. The coefficients on the latter three terms would estimate, respectively, the total effect of having a stationary bandit affiliated with either an external organization, a militia, or the FARDC, over and above the effect of the price

Table 3 presents the results. Columns 1–4 use the savings index, weddings, immigrants, and the welfare index, respectively, as dependent variables. Panels A and B, respectively, present the results for coltan and gold prices. The coltan price increases household welfare in locations where there is no stationary bandit (row 1), but its effect is identical in locations that have an external stationary bandit (row 2). However, its effect is 11% larger (p-value = 0) if the stationary bandit is instead affiliated to a militia (col. 4)—the FARDC is absent during the coltan shock. Similarly, both militia presence and FARDC presence are associated with a significantly larger effect of the gold price on household welfare (panel B). One may worry, for obvious reasons, that stationary bandits locate in support villages with better price response potential. Controlling for time-varying effects of constant village characteristics that predict their suitability for stationary bandits, however, leaves the results unchanged.[35] I next describe a strategy to identify a different estimand: the effect of different stationary bandits on household welfare.

C. *Effect of Stationary Bandits on Household Welfare: OLS and Instrumental Variables (IVs)*

1. OLS

I first implement the following specification:

$$W_{jt} = \beta_t + \alpha_j + \gamma_w \, \mathrm{SB}_{jt} + \varepsilon_{jt}, \tag{2}$$

where W_{jt} is any indicator for household welfare, and SB_{jt} is a dummy indicating the presence of a stationary bandit, which can be defined to be of a particular type (militia, external, or FARDC). Estimating this equation through OLS, the coefficient γ_w can be interpreted as the effect of a given stationary bandit on household welfare if $E[\varepsilon_{jt}|\mathrm{SB}_{jt}] = 0$. This assumption, however, is implausible, since stationary bandits likely select places where households are, or will become, richer. I tackle the endogeneity problem in the OLS framework in two ways. First, I include in all regressions controls for the, now familiar, price-mineral interactions. This captures the endogenous location choices that are driven by mineral demand. Second, I also implement the specification with leads (SB_{jt+1}) and lags (SB_{jt-1}, SB_{jt-2}) for the independent variables.

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on welfare when no stationary bandit is present. Implementing that regression shows that the presence of a militia or the FARDC leads price shocks to have a more positive effect on welfare than in the absence of any stationary bandit. For the security of our informants, some location data are not included in the replication file (available online); data with village names and location identifiers are available upon request.

[35] Table F.10 presents the results.

TABLE 3
Essential Functions of a State and Household Welfare—
Heterogeneous Effect of Prices

Variables	Savings Index (1)	No. of Weddings (2)	No. of Immigrants (3)	Welfare Index (4)
	A. Coltan Price (C_j)			
$C_j \times p_{c,t}$	.08*	.23***	.54***	.36***
	(.05)	(.08)	(.16)	(.08)
$C_j \times p_{c,t} \times \text{SB}_{jt}$	−.01	.01	.01	.02
	(.01)	(.02)	(.04)	(.02)
$C_j \times p_{c,t} \times \text{SB}_{jt} \times \text{Army}_{jt}$	−.01	.02	.03	.03
	(.01)	(.02)	(.05)	(.03)
$C_j \times p_{c,t} \times \text{SB}_{jt} \times \text{Militia}_{jt}$	.02**	.08***	.17***	.11***
	(.01)	(.02)	(.04)	(.03)
Observations	3,582	3,466	3,523	2,669
R^2	.36	.54	.40	.52
	B. Gold Price (G_j)			
$G_j \times p_{g,t}$	−.08	−.01	−.07	−.06
	(.05)	(.09)	(.14)	(.09)
$G_j \times p_{g,t} \times \text{SB}_{jt}$	−.00	−.02	−.04*	−.01
	(.01)	(.01)	(.02)	(.01)
$G_j \times p_{g,t} \times \text{SB}_{jt} \times \text{Army}_{jt}$	.00	.04**	.09***	.04***
	(.01)	(.02)	(.02)	(.01)
$G_j \times p_{g,t} \times \text{SB}_{jt} \times \text{Militia}_{jt}$	.00	.03**	.08***	.03**
	(.01)	(.01)	(.02)	(.01)
Observations	3,582	3,466	3,523	2,669
R^2	.36	.53	.39	.50

Note.—Standard errors are in parentheses. This table presents the results from specification 1 at the support village (where households are located), disaggregated by whether the support village was under a monopoly of violence held by an external armed actor, the FARDC, or a militia, which pools village and regional militias. Since a stationary bandit ($\text{SB}_{jt} = 1$) is affiliated with either a militia ($\text{Militia}_{jt} = 1$), the FARDC ($\text{Army}_{jt} = 1$), or an external organization ($\text{External}_{jt} = 1$), $\text{SB}_{jt} = \text{Militia}_{jt} + \text{External}_{jt} + \text{Army}_{jt}$. Thus, the additional effect of having an external stationary bandit, a stationary bandit from a (regional or village) militia, or a stationary bandit from the FARDC can be read, respectively, on the coefficients on the interaction that includes only SB_{jt}, $\text{Militia}_{jt} \times \text{SB}_{jt}$, and $\text{Army}_{jt} \times \text{SB}_{jt}$. Panel A presents the results for the coltan price and panel B those for the gold price. Column 1 presents the standardized (mean zero, standard deviation of one) household index for savings/investment. It uses as dependent variable an index that uses variables collected at the household level in the random sample of households in each village. For these variables, only household respondents who were settled in the village before 2000 were included, to control for compositional effects due to migration. The data of these households are then collapsed at the household × year level to reduce concerns of within–village × year intracluster correlation. Column 2 uses as dependent variable the logarithm of the number of weddings (+1). Column 3 presents the effects on the log of the number of migrants (+1). Column 4 uses a standardized welfare index (mean of zero, standard deviation of one), constructed using principal components of the household savings index, the logarithm of weddings, and the logarithm of the number of immigrants. The FARDC was absent before 2005, which is the time period when the coltan shock takes place. All regressions include year fixed effects and municipality fixed effects. Standard errors are clustered at the level of the municipality. Table F.10 presents results with controls for time-varying effects of a location suitability for a stationary bandit.

* $p < .1$.
** $p < .05$.
*** $p < .01$.

Table 4, panel A, presents the OLS estimation. Columns 1–4 implement specification 2, including Militia_{jt}, External_{jt}, and Army_{jt} as independent variables and using the household welfare outcomes of table 3 as dependent variables. The coefficient on Militia_{jt} is positive and significant at the 5% or 1% levels across the columns, indicating that having a stationary bandit from a militia increases the welfare index by 0.24 standard deviations. In contrast, the coefficient on External_{jt} is negative and significant only for weddings. Finally, the coefficient on Army_{jt} is positive and significant at the 1% level in most columns, indicating that having a stationary bandit from the Congolese army increases the household welfare index by 0.32 standard deviations. Importantly, a test of equality of coefficients rejects that the coefficient on Militia_{jt} (or Army_{jt}) and the coefficient on External_{jt} are equal, with a p-value of 0, while the coefficients on Militia_{jt} and Army_{jt} are indistinguishable. Columns 5–7 use the index of household welfare as a dependent variable and include, respectively, only Militia_{jt}, External_{jt}, and Army_{jt}. Columns 5–7, respectively, restrict the sample to observations with either a militia or no stationary bandit, with either an external stationary bandit or no stationary bandit, and with either a stationary bandit from the army or no stationary bandit. Coefficients thus capture the effect of a given stationary bandit over the alternative of no stationary bandit (and serve as comparison for the IV coefficients described next). The coefficients in columns 5–7 are also significant and positive for militias and the army and are negative and insignificant for external armed actors. The effects including leads and lags, reported in table F.11, are identical and unaffected by the inclusion of leads and lags.

2. IV

Since the OLS specification can be subject to other forms of endogeneity, I instrument for stationary bandit. In 2003, the RCD and some regional militias agreed to voluntarily withdraw from their territories, as part of the Sun City agreement. The agreement offered the RCD and major regional militias political benefits in exchange for withdrawal. The timing of the agreement is linked to the buildup of political pressure, including reports by international observers about the deadliness of the war. As a result, by 2005, the RCD, the major consortium of external armed actors at the time, and regional militias had abandoned most municipalities (Marchais 2016). If the peace agreement affected household welfare differentially only through the withdrawal of stationary bandits, the following 2SLS, using the targeted villages and those that had no stationary bandit in 2002, identifies the effect of having a stationary bandit of a given type:

$$\text{SB}_{jt} = \eta_j + \gamma_t + b\text{POST}_t \times \text{SB}_j^{2002} + u_{jt} \quad \text{(first stage)},$$

$$W_{jt} = \alpha_j + \beta_t + a\widehat{\text{SB}}_{jt} + \varepsilon_{jt} \quad \text{(second stage)},$$

TABLE 4
ESSENTIAL FUNCTIONS OF A STATE AND HOUSEHOLD WELFARE—EFFECT OF STATIONARY BANDITS

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Savings Index	No. of Weddings	No. of Immigrants	Welfare Index	Welfare Index	Welfare Index	Welfare Index	
				A. OLS				
$Militia_{jt}$	.05**	.16**	.46***	.24***	.20***			
	(.02)	(.06)	(.11)	(.06)	(.07)			
$External_{jt}$	.03	−.20***	−.13	−.07		−.04		
	(.03)	(.06)	(.11)	(.06)		(.07)		
$Army_{jt}$	.03	.25***	.42***	.32***			.48***	
	(.04)	(.08)	(.14)	(.08)			(.12)	
Observations	3,582	3,466	3,523	2,669	1,426	1,579	1,474	
R^2	.36	.54	.40	.51	.63	.63	.63	
Sample restriction	No	No	No	No	Yes	Yes	Yes	
p-value:								
Militia = External	.56	.00	.00	.00				
FARDC = External	.93	.00	.00	.00				
Militia = FARDC	.54	.33	.80	.48				
				B. IV (2SLS)				
	Savings Index	No. of Weddings	No. of Immigrants	Welfare Index	Savings Index	No. of Weddings	No. of Immigrants	Welfare Index
SB_{jt}	.01	.26	1.70***	.71***	−.05	−.27**	.99***	.25
	(.09)	(.18)	(.45)	(.21)	(.08)	(.13)	(.35)	(.19)

Observations	1,230	1,341	1,339	1,035	1,330	1,485	1,396	1,111
No. of clusters	123	153	152	121	133	161	158	129
Type		Militia stationary bandit				External stationary bandit		

NOTE.—Standard errors are in parentheses. This table presents the OLS and 2SLS estimates for the effect of different types of stationary bandits on household welfare. Standard errors are clustered at the level of the municipality. All regressions in both panels include year fixed effects, municipality fixed effects, and controls for $p_{c,t}^{US}$ and $p_{g,t}^{US}$. The results are unchanged, excluding such controls. Panel A presents the OLS results. Columns 1–4 implement specification 2, including as independent variables Militia_{jt}, External_{jt}, and Army_{jt} and using as dependent variables, respectively, the savings index, the number of celebrated weddings, the number of immigrants, and the index of household welfare. Columns 5–7 use the index of household welfare as dependent variable, and include, respectively, only Militia_{jt}, External_{jt}, and Army_{jt}, restricting the sample to observations with either a militia or no stationary bandit, observations with either an external stationary bandit or no stationary bandit, and observations with either a stationary bandit from the army or no stationary bandit. Coefficients are thus to be interpreted as the effect of a given stationary bandit over the alternative of no stationary bandit and serve as comparison for the IV coefficients of panel B. The contemporaneous effects including leads and lags, reported in table F.11, are identical, and leads are all insignificant. Panel B presents the 2SLS coefficients, which are estimated by instrumenting SB_{jt} (once for militia stationary bandits, then for external ones) with $\text{POST}_t \times \text{TARGET}_j$, and controlling for the presence of FDLR and FARDC members as stationary bandits. The dummy SB_{jt} indicates the presence of a (militia or external) stationary bandit. Columns 1–4 restrict the sample to support villages in which there is a militia stationary bandit in 2002, plus support villages in which there is no stationary bandit in 2002. Presence of a militia stationary bandit (SB_{jt}) is instrumented with the variable $\text{POST}_t \times \text{SB}, \text{Militia}_j^{2002}$. Columns 5–8 restrict the sample to support villages in which there is an external stationary bandit in 2002, plus support villages in which there is no stationary bandit in 2002. Presence of an external stationary bandit (SB_{jt}) is instrumented with the variable $\text{POST}_t \times \text{SB}, \text{External}_j^{2002}$. Columns 1 and 5 present the standardized (mean of zero, standard deviation of one) household index for savings/investment. They use as dependent variable an index that uses variables collected at the household level in the random sample of households in each village. For these variables, only household respondents who were settled in the village before 2000 were included, to control for compositional effects due to migration. The data of these households are then collapsed at the household × year level to reduce concerns of within–village × year intracluster correlation. Columns 2 and 6 use as dependent variable the logarithm of the number of weddings (+1). Columns 3 and 7 present the effects on the log of the number of migrants (+1 one). Columns 4 and 8 use a standardized welfare index (mean of zero, standard deviation of one), constructed using principal components of the household savings index, the logarithm of weddings, and the logarithm of the number of immigrants. Figure F.10 provides a balance test, fig. F.11 (and table F.12) presents the first stage, and a graphical representation of the reduced-form results is provided in fig. F.9. Table F.13 presents the results with target group time trends (target groups are defined by SB, $\text{Militia}_j^{2002} = 1$ and SB, $\text{External}_j^{2002} = 1$).

** $p < .05$.

*** $p < .01$.

TABLE 5
EXPLAINING THE INTENSIFICATION OF THE ESSENTIAL FUNCTIONS OF A STATE

Variables	Poll Tax (1)	Market Tax (2)	Toll Booth (3)	Mill Tax (4)	Tax Index (5)	Fiscal Administration (6)	Justice Administration (7)	Intensive-Margin Index (8)
				A. Unconditional				
$\text{Coltan}_j \times p_{c,t}$	.02	−.03**	−.00	−.00	−.02	−.05**	−.05**	−.07
	(.03)	(.02)	(.02)	(.01)	(.04)	(.02)	(.02)	(.04)
$\text{Gold}_j \times p_{g,t}$	.04	.07**	.05	−.01	.13*	.07**	.06	.16**
	(.05)	(.03)	(.04)	(.02)	(.08)	(.03)	(.04)	(.07)
Observations	4,302	4,289	4,302	4,302	4,289	4,302	4,302	4,289
R^2	.43	.48	.50	.45	.48	.50	.48	.51
				B. Conditional				
$\text{Coltan}_j \times p_{c,t}$	.00	−.04**	−.001	−.00	−.05	−.08***	−.08***	−.12***
	(.02)	(.02)	(.02)	(.01)	(.03)	(.02)	(.02)	(.03)
$\text{Gold}_j \times p_{g,t}$	.03	.07**	.02	.00	.11*	.09***	.07**	.16***
	(.04)	(.03)	(.03)	(.02)	(.06)	(.03)	(.03)	(.06)

Observations	4,257	4,244	4,257	4,257	4,244	4,257	4,257	4,244
R^2	.72	.61	.62	.52	.76	.71	.70	.81

NOTE.—Standard errors are in parentheses. This table presents the results from specification 1, using as dependent variables the vector of "sophisticated" taxes in cols. 1–4 (poll taxes, food market taxes, toll booths at the village, and mill tax), a tax sophistication index (col. 5), a dummy for fiscal administration at the village (col. 6), a dummy for justice administration at the village (col. 7), and an overall intensive-margin index (col. 8). The fiscal sophistication index (top row) was constructed as follows. First, for each tax instrument $i = 1, 2, \ldots, N$, for all years $t = 1, 2, \ldots, T$ and villages j in which a stationary bandit uses it, I compute the proportion of observations in which the stationary bandit holds a fiscal administration. This yields a weight $w_i \in [0, 1]$ for each tax that proxies for the degree to which tax instrument i is associated with investments in fiscal administration. A high w_i thus indicates that tax i is associated with a high cost of collection. Then, for each tax vector observed at year t in village j, I compute the following weighted average: $I_{jt} = \Sigma_{i=1}^{i=N}. w_i T_{ijt}$, where w_i are the tax instrument weights and T_{ijt} is a dummy indicating whether tax i is collected at time t in village j. For interpretation purposes, I then normalize I_{jt} by subtracting its mean and dividing by its standard deviation: $I_{jt}^{\text{normalized}} = [I_{jt} - (1/NT)\Sigma_j\Sigma_t I_{jt}]/\{(1/NT)\Sigma_j\Sigma_t[I_{jt} - (1/NT)\Sigma_j\Sigma_t I_{jt}]^2\}^{1/2}$. The overall intensive-margin index is constructed using principal component analysis for ordinal-scale items on the tax sophistication variable and an index of administrative development, and the outcome is then normalized to mean zero and standard deviation of one. The index of administrative development is constructed via principal component analysis for ordinal-scale items on the following two dummies: village fiscal administration and village justice administration. As with the other indexes, I then normalized to units of standard deviation centered around the mean. To separate selection effects induced by a change in composition from changes of stationary bandits' behavior, panel B shows the results including stationary-bandit organization fixed effects. For the conditional analysis, identification stems from changes in intensive-margin outcomes within organizations, within village, across time. All regressions include year fixed effects and municipality fixed effects, and standard errors are clustered at the level of the municipality. Section E reports the results of 13 robustness tests. The results, presented in table F.14, are robust to these tests (except for one). Table F.15 presents the results excluding the Congolese army (FARDC), and table F.16 presents the results including only the FARDC.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

where POST_t indicates years on or after 2003 and SB_j^{2002} indicates whether a location was under the control of a stationary bandit (of a given type) in 2002. Coefficient a estimates the local average treatment effect for support villages that "comply"—where the stationary bandit leaves in response to the peace agreement (and would otherwise have stayed). The RCD was the only external group included in the agreement (and the largest). Thus, for this analysis, I code External_{jt} as RCD. Villages with different types of stationary bandit in 2002 were similar (fig. F.10).

I follow the following steps to support the causal interpretation of the estimating equation. First, since villages may be taken in response to their tax potential, I include controls for mineral endowments interacted with their prices in the baseline regressions (adding the controls does not change the results). Second, since the coltan price shock of the year 2000 led to a drastic reallocation followed by stability, I exclude years preceding the coltan boom, and I select the interval of years for the analysis among the remaining years as the one that maximizes the coefficient on $\text{POST}_t \times \text{SB}_j^{2002}$ in the first stage for militias and external armed actors, 2002–11. Compliance of support villages is, respectively, 82%, 91%, and 87% for village militias, regional militias, and external stationary bandits. The *F*-test for the first-stage model (table F.12) is above 20 across the board (and is larger without price controls). Third, since the FARDC appears after 2005 and the FDLR (a militia excluded from the peace agreement) remains present, I also control for presence of the FARDC and the FDLR (adding these "bad" controls leaves the result unaffected). In addition, I examine whether the results are robust to restricting to the years in which the FARDC is absent (2002–05). Fourth, I replicate the analysis with treatment group time trends.

Panel B of table 4 presents the IV results. Columns 1–4 restrict the sample to support villages in which there is either a militia or no stationary bandit in 2002 and instruments the presence of a militia stationary bandit with $\text{POST}_t \times \text{SB}_j^{2002}$. Having a militia stationary bandit is associated with a welfare index higher by 0.71 standard deviations (col. 4), significantly higher than the OLS coefficient of panel A, column 5, and robust to the inclusion of time trends (table F.13). Columns 5–8 restrict the sample to villages that have either an external stationary bandit (RCD) or no stationary bandit in 2002 and instruments the presence of an external stationary bandit with $\text{POST}_t \times \text{SB}_j^{2002}$. The coefficient on external stationary bandits is not significant for the welfare index (col. 8). Including time trends (table F.13), the coefficient is positive and significant. However, it vanishes when I restrict the analysis to the years 2002–05. As in the OLS results, militias lead to a robust increase in household welfare on net, and external actors do not.[36]

[36] Figure F.10 presents a balance test, and fig. F.11 presents the composition of stationary bandits through the shock. Figure F.11 shows that, in response to the peace agreement, militias

D. Do Households Like Stationary Bandits?

Implicit association tests (IATs) provide additional support to the welfare results. In an additional survey round, surveyors administered an audio IAT, designed to measure the biases that (potentially illiterate) households have toward known armed groups, to a random sample of 10 households in most of the 106 support villages of the Nord Kivu sample. Households played multiple rounds, which included cues for external armed actors (RCD, M23, FDLR, and the colonial state), the FARDC, and known popular militias (Raia Mutomboki, Mayi-Mayi). Results are shown in figure F.13. Subjects have a significant and comparable negative bias toward external armed actors and the colonial state and a positive bias toward popular militias, FARDC, and chiefs.

VI. Intensification of the Essential Functions of a State

A. Explaining the Intensification of the Essential Functions of a State

Table 2 (panel C) also describes the intensive-margin outcomes defined Section II.D. The FARDC holds an (illicit) fiscal administration in 16% of the years when they have a stationary bandit in a village, against 68% for external armed groups, 68% for regional militias, and 47% for village militias.

Panel A of table 5 presents the results from specification 1, using as dependent variables the vector of "sophisticated" taxes in columns 1–4 (poll taxes, food market taxes, toll booths at the village, and mill tax), a tax sophistication index (col. 5), a dummy for fiscal administration at the village (col. 6), a dummy for justice administration at the village (col. 7), and an overall intensive-margin index (col. 8).[37] The table indicates that the gold

and external armed actors withdraw. Furthermore, while the FARDC takes support villages in the aftermath, the proportion is negligible until 2005. Figure F.12 presents the reduced form. Welfare is consistently higher in militia municipalities, which appear shielded from the conflict. After 2003, the rest of municipalities catch up from lower welfare during the conflict. Table F.13 presents the results including treatment group time trends.

[37] The tax sophistication index (top row) was constructed as follows. First, for each tax instrument $i = 1, 2, ..., N$, for all years $t = 1, 2, ..., T$ and villages j in which a stationary bandit uses it, I compute the proportion of observations in which the stationary bandit holds a fiscal administration. This yields a weight $w_i \in [0, 1]$ for each tax that proxies for the degree to which tax instrument i is associated with investments in fiscal administration. A high w_i thus indicates that tax i is associated with a high cost of collection. Then, for each tax vector observed at year t in village j, I compute the following weighted average: $I_{jt} = \sum_{i=1}^{i=N} w_i T_{ijt}$, where w_i are the tax instrument weights and T_{ijt} is a dummy indicating whether tax i is collected at time t in village j. For interpretation purposes, I then normalize I_{jt} by subtracting its mean and dividing by its standard deviation:

$$I_{jt}^{\text{normalized}} = \frac{I_{jt} - (1/NT)\sum_j \sum_t I_{jt}}{\sqrt{(1/NT)\sum_j \sum_t \left(I_{jt} - (1/NT)\sum_j \sum_t I_{jt}\right)^2}}.$$

price leads to a rise in taxes on the food market at the village (col. 2), an overall increase in tax sophistication (col. 5), an increase in the likelihood that a stationary bandit holds a fiscal administration (col. 6), and an increase in the intensive-margin index (col. 8). While the coltan price leads stationary bandits to hold monopolies of violence at coltan mines, it also leads them to dismantle their administration at the support village—an "administration resource curse."

A specific selection problem applies, however, to the analysis of the intensive margin. Price shocks may change the composition of stationary bandits. Yet, as seen in table 2 (panel C), stationary bandits differ widely in their intensive-margin "styles." To isolate the changes in stationary bandits' incentives and behavior from changes in their types, panel B of table 5 shows the results including stationary-bandit organization fixed effects. Accounting for changes in composition significantly strengthens the results. Both effects are strengthened when I exclude the FARDC, and they vanish when I keep only the FARDC, indicating that the effect is not driven by the FARDC.[38] Figures 5*A* (unconditional) and 5*B* (conditional) provide a graphical representation.[39]

B. What Else Do Stationary Bandits Do?

Stationary bandits intensify the essential functions of a state in ways deeper than those that are contemplated in the testable implications of section II.D. First, in approximately 60% of episodes, the stationary bandit has developed formal documents and official seals. Second, they occasionally create local markets and regulate local businesses in 6% of episodes. Third, they run propaganda campaigns aimed at acquiring legitimacy in 41% of episodes and conduct initiation rituals in 29% of episodes. Furthermore, in 17% of episodes, they conduct witch hunts to crush opposed spiritual leaders, so as to maintain the endorsement of the guardians of local belief systems. Finally, while they replace traditional chiefs in 55% of episodes, they create indirect rule with local chiefs in the rest.[40] What explains

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I also construct an administrative development index, using principal component analysis for ordinal-scale items on village fiscal administration and village justice administration. As with the tax sophistication index, I then normalized to units of standard deviations centered around the mean. I use both the tax sophistication index and the administrative development index to compute an overall intensive-margin index, which I use in col. 8. This index is constructed by using principal component analysis for ordinal-scale items on the tax sophistication variable and the administration index variable, normalized to a mean of zero and a standard deviation of one.

[38] Tables F.15 and F.16 present the results excluding, respectively, the FARDC and all other stationary bandits.

[39] The results remain in 12 out of 13 robustness tests, presented in table F.14. The null that the coefficient is zero fails to be rejected in the Arellano-Bond estimation, although it remains when the lagged dependent is included.

[40] See table F.1 and figs. F.14–F.17 for additional details.

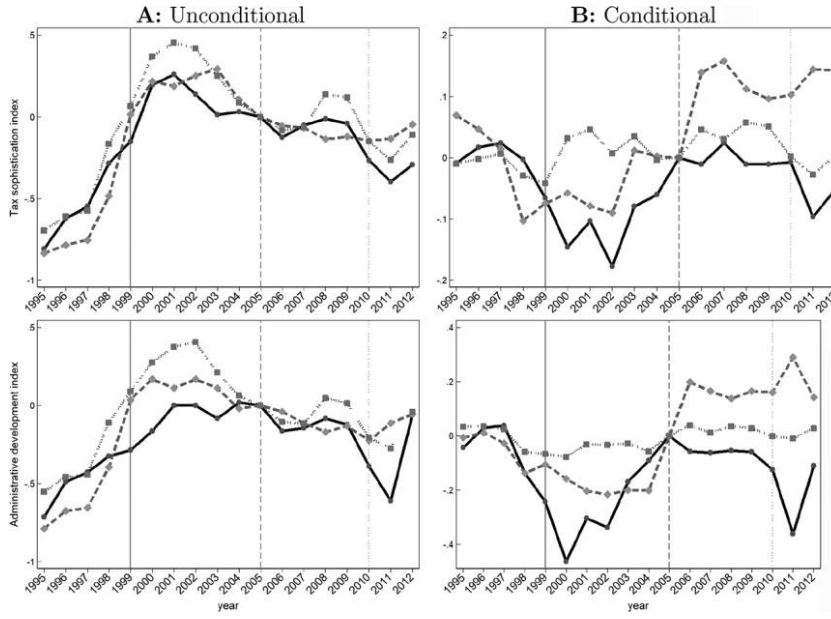

FIG. 5.—Explaining the intensification of the essential functions of a state. This figure presents the intensive margin of the essential functions of a state: fiscal sophistication and administration. *A*, Unconditional fiscal sophistication index and administrative development index (and thus reflects the change in stationary bandits' behavior as well as the change in composition of stationary bandits). The fiscal sophistication index (*top*) was constructed as follows. First, for each tax instrument $i \in \{1, N\}$ for all years t and villages j in which a stationary bandit uses it, I compute the proportion of observations in which the stationary bandit holds a fiscal administration. This yields a weight $w_i \in [0, 1]$ for each tax that proxies for the degree to which tax instrument i is associated with investments in fiscal administration. A high w_i thus indicates that tax i is associated with a high cost of collection. Then, for each tax vector observed at year t in village j, I compute the following weighted average: $I_{jt} = \Sigma_{i=N}^{i=1} = w_i T_{ijt}$, where w_i are the tax instrument weights and T_{ijt} is a dummy indicating whether tax i is collected at time t in village j. For interpretation purposes, I then normalize I_{jt} by subtracting its mean and dividing by its standard deviation: $I_{jt}^{\text{normalized}} = [I_{jt} - (1/n)\Sigma_j\Sigma_t I_{jt}]/\{(1/n)\Sigma_j\Sigma_t[I_{jt} - (1/n)\Sigma_j\Sigma_t I_{jt}]^2\}^{1/2}$. The administration index (*bottom*) was constructed via principal component analysis for ordinal-scale items on the following two dummies: village fiscal administration and village justice administration. As with the tax sophistication index, I then normalized to units of standard deviation centered around the mean. *B*, Conditional time series. In particular, I first regress the fiscal sophistication index and the administrative development index onto dummies indicating each armed group organization and use the residual. This procedure thus accounts for changes in the outcomes that may be due to changes in armed-organization composition, a major concern after the Second Congo War. The time series thus reflects only changes in stationary bandit behavior, holding constant their particular armed-group style. The solid and the dashed lines indicate, respectively, the proportions for coltan sites and gold sites. The dotted line marks the proportion of locations endowed with any other resource (including the matched subsistence agriculture sample of Kalehe). A support village is coded as "other" if its municipality has neither gold nor coltan mines. The proportions are expressed in deviations from their 2005 levels, the first year after the Second Congo War, which ended in drastic changes in composition. A color version is available online.

that they attempt to have or succeed in having legitimacy and the design of their political institutions are left for further research (Henn, Marchais, and Sánchez de la Sierra 2018).

VII. Conclusion

While they can be arbitrarily violent, armed actors sometimes paradoxically establish a monopoly of violence, tax, and provide protection if there is a surplus they can continuously expropriate—creating the essential functions of a state. When it is profitable to do so, armed actors may also intensify such functions by sophisticating their taxation practices, creating a fiscal administration, and administering justice. In some cases, thus established monopolies of violence may increase the well-being of households under them—if the value of the protection they provide outweighs the distortionary effect of their taxation, and especially when the armed actors' objective is aligned with the population's welfare. This paper has provided suggestive evidence for those findings in the context of armed actors in the eastern DRC, where armed actors regularly operate and can sophisticate their expropriation practices without immediate consequences for them.

This account treats the relationship between stationary bandits and the population mechanically in a taxation framework. However, in reality, armed actors and states-in-formation alike struggle to obtain legitimacy, which they need for governing better. When lacking legitimacy, armed actors in the DRC often use local intermediaries. What legitimacy is, how actors acquire it, and what they need it for are empirically understudied questions that are beyond this paper's goal. Future research into those questions would greatly benefit understanding of the process of state formation.

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