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Public Healthcare Financing during Counterinsurgency Efforts: Evidence from Colombia*

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Abstract

How do government counterinsurgency efforts affect local public health financing during civil conflicts? We investigate this question in the context of the protracted conflict in Colombia. Using data on antinarcotics operations and health transfers from the central government to municipal governments, we employ both panel estimations and an instrumental variable to address concerns of endogeneity. We first show evidence of a government discretionary power over the allocation of health transfers. We do not find evidence that counterinsurgency operations causally affect health transfers to municipalities. Our results rule out political alignment between mayors and the national governing party as an intermediary factor that could influence the flow of fiscal transfers in municipalities exposed to the conflict.

I. Introduction

Internal conflicts have severe and long-lasting negative consequences for health and development. Population health is affected not only through the immediate effects of violence exposure on casualties and morbidity, but also – particularly in the case of protracted civil confrontations – by a complex chain of interactions between the government forces, rebel armed groups, and local civilian populations. These interactions manifest themselves in longer-term consequences for the provision and access to public services, with potentially wider health, social, and economic consequences (Kirschner and Finaret, 2021; Palmer *et al.*, 2019; Singhal, 2019).

Although counterinsurgency efforts aim to weaken illegal armed groups and restore state control and legitimacy, a large body of literature has shown that they might also fuel local violence (Kalyvas, 2006; Staniland, 2012; Dell, 2015; Dube and Naidu, 2015). Beyond direct harmful health effects, exposure to violence may also affect population health through increased mental disorders, malnutrition, and higher vulnerability to

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disease (Camacho, 2008; Akresh, Verwimp, and Bundervoet, 2011; Buitrago and Moreno-Serra, 2021), displace populations, and hamper healthcare utilization (Molina, 2020).

In this paper, we examine how governments allocate public health resources amid counterinsurgency efforts. Focusing on fiscal transfers from the central government, the most important source of revenue for municipalities in Colombia, we investigate whether government-sponsored operations to disrupt drug production and trafficking activities (as key funding sources for armed groups) during the last decade of the protracted conflict have led to changes in fiscal transfers for health, before or after such interventions. Evidence shows that effective targeting of centralized fiscal transfers are important in mitigating poor outcomes in policy areas such as education, poverty, and health (Brutti and Torres, 2022; Litschig and Morrison, 2013; Uchimura and Jütting, 2009; Asfaw *et al.*, 2007). Although we explore the fiscal response of antinarcotics operations through alternative channels (transfers for education, water and sanitation, and general public purposes), we hypothesize that any government's response to mitigate the adverse consequences of the conflict on population health should primarily operate through health transfers. Public health expenditures could play an important role in mitigating adverse health outcomes of armed conflicts through increased access to healthcare and healthcare quality (Franco *et al.*, 2006). Morbidity and mortality from armed conflicts are likely to result in reductions in preventable care use, nutritional intake, health personnel, and supplies and medication, all of which can undermine population health and increase demand for more complex healthcare in the future (Ramos Jaraba *et al.*, 2020). Examining how public health resources are allocated during conflicts can help elucidate an important mechanism through which conflicts affect population health and the health sector.

To motivate our analysis, we start by offering five different pieces of evidence that present a consistent picture of some form of discretionary power in resource transfers by the central government. We first demonstrate that government transfers vary much more widely than what the formula-based allocation would predict. Second, we present case studies with the two largest cities in Colombia, which highly differ in their exposure to the civil conflict, and show that the yearly variations in the growth rate of health transfers are unlikely to be driven by random noise. Third, we show that these variations in health transfers are not caused by external aid, which could have been a major alternative channel to explain these variations. Fourth, by using OLS regressions of health transfers on the share of population enrolled in subsidized health insurance, we find evidence that the share of health resources allocated to the subsidized scheme is below the minimum share of resources prescribed by the relevant legislation. Fifth, we present evidence that government health transfers are associated with political motives, by exploiting data on mayoral election outcomes. Our overall result about the existence of discretionary power by the Colombian government agrees with the findings from previous studies from countries beyond Colombia: although formula-based intergovernmental transfers have initially been designed to limit the influence of political considerations, evidence suggests that this mechanism has not been sufficient to eliminate politically motivated transfers (Khemani, 2003; Calvo and Murillo, 2004; Banful, 2011; Caldeira, 2012; Fossati, 2016). In Mexico, Timmons and Broid (2013) show that although the government's actions are limited by the allocation formula, its ability to modify the allocation of transfers to municipalities remains significant.

We identify several plausible ways through which the government's allocation of public health resources might strategically respond to counterinsurgency efforts. First, governments might aim *ex-post* to mitigate potential adverse effects on population health of large-scale operations against illegal armed groups, by reallocating resources to the affected populations who may have experienced higher exposure to violence during the counterinsurgency operations. In Colombia, the human costs of counterinsurgency among civilian populations have been far from negligible, either through triggering 'uncontrolled' attacks against civilians (Dube and Naidu, 2015; Acemoglu *et al.*, 2020), or by leading to harmful health effects on surrounding populations (Camacho and Mejía, 2017). Second, the central government may anticipate surges in local healthcare demand following an antinarcotics operation and reallocate public healthcare resources accordingly *ex-ante*, to mitigate potential adverse health effects in the local community, also as a way of reinforcing state legitimacy locally (Bertone *et al.*, 2019). Third, the central government might opt for cutting down their fiscal transfers before antinarcotics operations in a community, seeking not only to erode local support for the presence of illegal armed groups (Berman, Shapiro, and Felter, 2011) but also to free up resources for an *ex-post* increase in fiscal transfers to that community. In particular, Berman *et al.* (2011) develop a model where the government seeks to win 'hearts and minds' through a combination of hard military operations and service provision. The predictions of this model have been tested to examine how service provision could shape the civilian response during wartime (Lyall, Blair, and Imai, 2013), the incidence of conflict (Crost, Felter, and Johnston, 2014), or could be used in combination with economic aid as a tool for increasing government trust and reducing support for insurgent activities (Evans, Holtemeyer, and Kosec, 2019; Fetzer, 2020). The net result of the interaction between antinarcotics operations and public healthcare financing will depend on the presence and magnitude of the changes in public financing. If the government seeks to win 'hearts and minds', we expect to observe changes in the flow of health resources allocated to municipalities involved in the conflict. The sequential allocation of these funds should provide information about the specific strategy adopted by the government. Therefore, the question of how government counterinsurgency interventions influence health financing flows constitutes, essentially, an empirical matter.

Our key contribution to the literature is to test empirically the existence of a causal public health financing response to counterinsurgency operations, using information at the subnational level. Thereby, we can effectively examine whether and how governments use fiscal policies as a strategic complementary tool for their counterinsurgency activities. The existing evidence is not very informative about the dynamics of public financing during large-scale internal violence. In particular, we know very little about how publicly financed healthcare, which is often the only source of care access for poor populations (WHO, 2010, 2015), responds to large armed government interventions against illegal groups. As one exception, Gupta *et al.* (2004) concluded that health spending as a share of GDP remains constant in conflict-affected countries, whilst the public deficit tends to increase. Yet their analyses rely on cross-national aggregate data, whilst the often regional nature of internal conflicts and public financing arrangements imply that important variations in public (healthcare) financing are likely to take place at lower geographical levels. In most of the low-and middle-income countries, intergovernmental

transfers are crucial to fill fiscal gaps and represent a major source in financing local infrastructure for the provision of health services (Bird and Smart, 2002).

We analyse longitudinal data on antinarcotics operations and health-related and general public transfers from the central government to Colombian municipalities between 2002 and 2015. To address potential endogeneity concerns in the relationship between public healthcare financing at the municipality level and the implementation of counterinsurgency operations, we use an instrumental variable strategy: we create a shift-share instrument based on US military aid flows and the probability that counterinsurgency operations are undertaken in a given municipality. We also investigate the potential adverse effects of counterinsurgency measures on the levels of local violence in future periods. We conduct a set of robustness checks, including those related to the validity of the instruments and the dynamics of the effects, and investigate the heterogeneity of the effects by municipality characteristics such as financial dependence on the central government.

We find no evidence that more antinarcotics operations in a municipality causally lead to any significant changes in the growth of fiscal health transfers to this municipality, either before or after the event. Our estimates from different econometric specifications are all tightly bounded around zero. We verify that antinarcotics operations significantly affect the level of violence in targeted municipalities as shown in the existing literature (Dube and Naidu, 2015), and demonstrate a significant effect both before and after the operations. Finally, our results rule out political alignment between mayors and the national governing party as an intermediary factor that could influence the flow of fiscal transfers. Although we cannot rule out any other alternative policies through which the government may reach the populations affected by counterinsurgency operations and the ensuing violence, the absence of any effect on the most important funding source for health (and the most direct channel through which the government can protect population health) strongly suggests that the local health needs might not be adequately met.

Our findings speak directly to the literature that links public finance and conflict. As both rebels and the state engage in conflict to control territory and increase tax revenue, local tax institutions are prone to capture by the armed actors and may contribute to feeding internal conflicts (Ch *et al.*, 2018). On the other hand, once the state has secured control over its local institutions, the reward of potentially higher tax revenue may reduce the opportunity cost of violence and boost counterinsurgency efforts (Shapiro and Vanden Eynde, 2023).

Our findings also feed into the literature on the political motives behind intergovernmental transfers. The allocation of intergovernmental transfers may be used by the central government to reward local political support or punish enemies (Arulampalam *et al.*, 2009; Brollo and Nannicini, 2012), even if such transfers are determined by a formula-based allocation rule (Banful, 2011). Political alignment may therefore be a significant driver of fiscal transfers. Yet we find that health transfers remained largely unaffected by the political party affiliation of mayors, even in closely contested municipal elections. A possible explanation could be that the absence of the rule of law and the prevalence of clientelism and regional elites may foster the exchange of private goods rather than any additional allocation of public resources (Robinson, 2007). Finally, our finding of the lack of increased public health resources in conflict-affected areas points to an additional potential pathway in the relationship between conflict and population health (Ramos Jaraba *et al.*, 2020).

Our paper is organized as follows. Section II describes the Colombian conflict and health system. Section III introduces the conceptual framework. We present the empirical strategy in section IV and discuss the data in section V. Section VI presents the main results on health transfers, general public funds and local violence. Section VII explores the treatment effect heterogeneities, and section VIII concludes. Additional results are provided in an Appendix S1.

II. Background

Financing of the Colombian health system

The Colombian health system hinges on the provision of a universal health insurance plan that is financed by two schemes: a contributory and a subsidized regime.[1] The contributory regime is a mandatory health insurance scheme that covers all formal workers along with their dependents, and is financed by a payroll tax.[2] The poorest and most vulnerable populations are covered under the subsidized regime. The latter identifies its beneficiaries through a proxy means test index based on the socio-economic conditions of each household and standardized at the national level. The Fund of Solidarity and Assurance (FOSYGA) collects all payroll contributions of the contributory regime as well as public funds raised through general taxes and redistributes the pooled funds mostly between the contributory and the subsidized regimes (Camero Nader *et al.*, 2016).[3]

Although Colombia's tax collection system is a centralized one, it heavily relies on local administrations for the provision of public services. The Colombian intergovernmental transfers, known as *Sistema General de Participaciones* (General Sharing System, SGP) are funds from the central government budget that are allocated to departments and municipalities to finance health, education, water and sanitation, and other general purposes.[4] Figure 1 highlights that health and education are the two most important components of the fiscal transfers during the 2002–15 period. Whilst all transfers increased over the period, transfers to education rose the most rapidly.

In this fiscal decentralization arrangement, departments[5] assume an intermediary role where they use fiscal transfers and their own resources to shape regional economic development, coordinate actions between municipalities and the central government, and

[1]Additional special social security schemes cover teachers in public schools and universities, the military and police officers, and workers of the national oil company. These special schemes cover about 5% of Colombia's population.

[2]The contributory regime also includes the self-employed and those with financial capacity to pay (Camero Nader *et al.*, 2016).

[3]FOSYGA designates as Compensation and Solidarity the subaccounts which relate to the contributory and subsided regimen respectively, to distinguish between the in-flow and out-flow of funds. More than 90% of the pooled funds are allocated to the compensation and solidarity subaccounts of the FOSYGA. The remaining funds are used for health promotion activities and cover catastrophic illnesses and traffic accidents (ECAT). Note that in 2017, FOSYGA was replaced by the Administrator of the Resources of the General System of Social Security (ADRES). Because this change happened after the period examined in our empirical work, we refer to this institution as FOSYGA throughout the paper.

[4]SGP represents more than 75% of national revenues; another source of government funding to departments and municipalities is the *Sistema General de Regaltas* (General System of Royalties, SGR) which takes its revenue from the exploitation of oil and other natural resources and aims to finance investment projects in the producing municipalities.

[5]Departments are subdivided into municipalities and are equivalent to provinces in other national contexts.

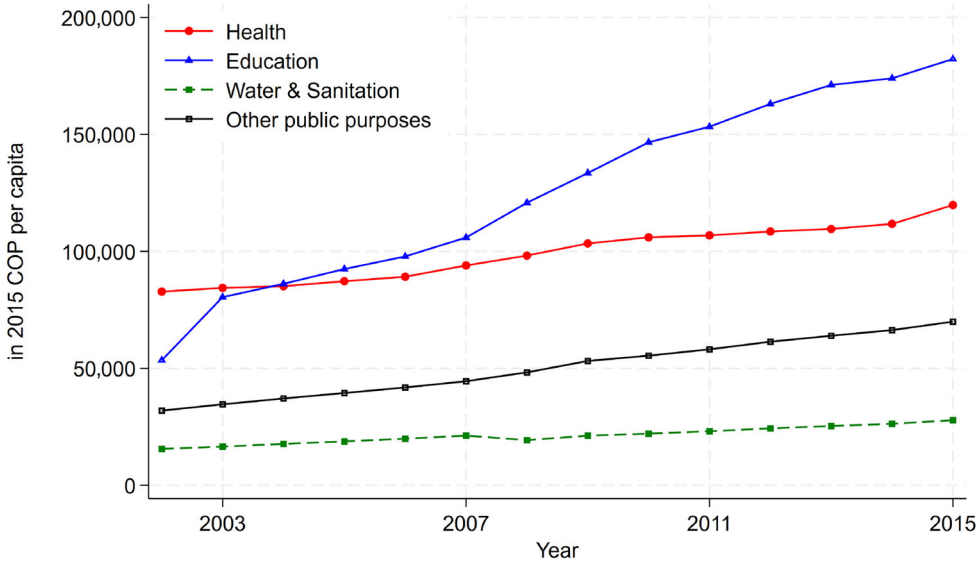

Figure 1. Evolution of fiscal transfers to municipalities.
Notes: The graph plots the evolution of fiscal transfers to municipalities decomposed into four categories: health, education, water and sanitation and general public purposes. Data on fiscal transfers were collected from the National Planning Department (NPD). [Colour figure can be viewed at wileyonlinelibrary.com]

allocate nationally earmarked funds (Bird, 2012). Departments and municipalities heavily depend on fiscal transfers to ensure the local provision of public services and achieve their fiscal consolidation objectives: the central government transfers represent half of the funding sources of the two territorial entities, the remaining part being the municipality's own revenues consisting of local tax (28%) and non-tax income (Bonet-Morón, Pérez-Valbuena, and Ayala-García, 2016). Fiscal transfers are first allocated to the relevant sector ministries (health, education, water and sanitation) before being distributed across departments and municipalities. Through these ministries, the central government exerts tight control on subnational government spending from each of the earmarked transfers, and municipalities are only allowed to decide on the distribution of public spending that originates from their own resources. Transfers are distributed according to population needs, administrative efficiency, and equity criteria at the municipality level. In the health sector, the health component of the earmarked transfer is allocated to the subsidized regime, public health (about 10%) and to fund healthcare for the poor population unaffiliated with a health insurance scheme. Together, SGP and FOSYGA account for more than 90% of total public health spending (Calderón *et al.*, 2011).[6] Additional funds provided by the departments and municipalities' own budgets are devoted to public health and to the unaffiliated poor population. In total, public healthcare spending represents about 80% of total health expenditures in Colombia (OECD, 2015). The importance of SGP in financing public healthcare in Colombia is crucial: it finances more than half of

[6]SGP accounts for two-thirds of the national government health budget, the remaining resources being allocated to the health sector mainly by the Ministry of Defence (military hospitals) and the Ministry of Social Protection (Núñez *et al.*, 2012).

the subsidized regime, in addition to public health and the poor uninsured population. More than one-third of the departmental healthcare spending and half of the municipality healthcare spending comes from the intergovernmental allocations (Orozco-Gallo, 2015).

Government transfers in Colombia should, in theory, be allocated according to a formula based on an index of socioeconomic vulnerability, the System of Identification of Social Programme Beneficiaries (SISBEN), which determines individual eligibility to social programmes (OECD, 2015).[7] However, the legislation gives the central government considerable flexibility to modify the actual resources transferred to a given municipality, with respect to the allocation stipulated by the formula (see section B in the Appendix S1 for a detailed description of the transfer procedure). Likewise, evidence of formula-based intergovernmental transfers in other countries shows that a significant share of allocations remains politically motivated and arbitrarily manipulated at the central level (Banful, 2011; Timmons and Broid, 2013), and even under a strict legal framework (Acuna, Balza, and Gomez-Parra, 2024). Figure 2 displays, for all Colombian municipalities, kernel densities of yearly variations (percentage change) in health transfers per enrolled to the subsidized scheme. The graphs show substantial year-on-year variations in health transfers for one-third of the municipalities, beyond the maximum growth rate prescribed by the law (4%).

The additional evidence presented in the section C in Appendix S1 supports the view that these large yearly variations in health transfers are not randomly driven. We present two case studies with the two largest Colombian cities, Bogotá and Medellín, that epitomize the regional disparities of the civil conflict. We document that government transfers to Bogotá remain fairly stable, with only small changes that could be attributed to central or local administrative costs, and substantial variations in Medellín of up to 80% during the 2003–10 period, a period that matches a major crackdown on illegal drug trafficking in the country. We further present evidence that the variations in health transfers are not driven by external sources, and do not match the minimum share of the poor population enrolled in the subsidized scheme as prescribed by the law. Lastly, we present in the Appendix S1 (section C.4) evidence that political motives play a significant role in determining the growth rate of health transfers. Altogether, these findings increase our confidence that substantial unexplained variations in health transfers exist in Colombia, likely pointing to the presence of a non-negligible discretionary power in health fiscal transfers by the central government. Our analysis focuses on understanding these variations with respect to counterinsurgency efforts.

The Colombian armed conflict

The roots of the long-lasting armed conflict in Colombia can be tracked back to the episode of *La Violencia*, a bipartisan conflict that turned into a civil war between 1948 and 1958,

[7]The transfer system and criteria of allocation have been established in Law 715 of 2001, which in practice established a direct link between central transfers and the share of the local population identified as socio-economically vulnerable, as well as setting the yearly growth rate of SGP; in a new law (1176) in 2007, a separate subcomponent was created for water and sanitation; in 2011, Law 1438 stipulated that 10% of health resources should be specifically allocated to public health. Overall, the growth rate of SGP was set to increase by 2%–4% during our study period (Bonet-Morón *et al.*, 2016).

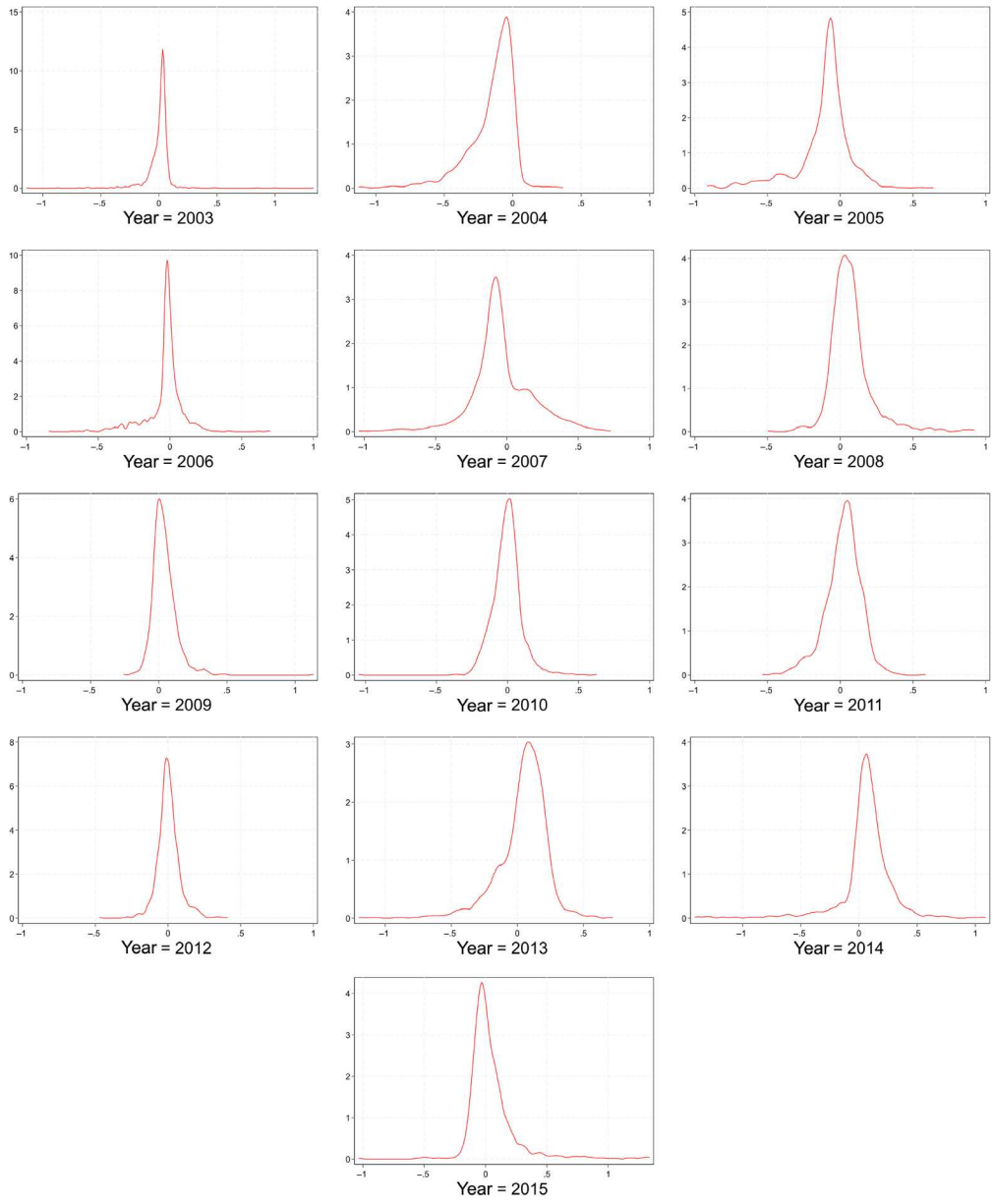

Figure 2. Yearly percentage change in health transfers.
Notes: Each graph plots the kernel density estimate (red curve) of the percentage change in health transfers per enrolled to the subsidised scheme, for any given year between 2003 and 2015. The mean and median for the overall data sample are −0.3% and 0.08% respectively, and become 10.7% and 14.9% once we restrict the data sample to observations with a percentage change higher than what is prescribed by the law (4%). The restricted sample contains 34.3% of observations from the overall sample. [Colour figure can be viewed at wileyonlinelibrary.com]

claiming the lives of more than 160,000 people (Durán-Martínez, 2017). The conflict ended with a pact to share control over the state between the two major parties, the Liberals and Conservatives. This elite arrangement excluded any other political forces and contributed to the rise of left-wing guerrilla movements such as the Armed Revolutionary Forces of Colombia (FARC), claiming their right to participate in the public space. Although the pact ended in 1974, tensions between the state and the guerrillas continued to increase and the prominent role of the FARC in some territories triggered the creation of a paramilitary 'self-defence' movement, comprising local private armies, to fight the guerrilla groups in territories abandoned by the state, ultimately intensifying the conflict. Meanwhile, the transformation of the country into an illegal crop producer created an opportunity for rent extraction by non-state actors (Durán-Martínez, 2017). Both guerrillas and paramilitaries were often found to have links with the control, production and trafficking of cocaine. They have also both been accused by international human rights organizations of massacring civilians. The alarming levels of political and drug-related violence generated by the armed conflict between the state, guerrillas, and paramilitaries have put local communities in constant danger, with none of the actors able to guarantee their security (Arias and Goldstein, 2010). In addition, limited access to healthcare in conflict-affected areas is likely to have exacerbated the detrimental effects of exposure to violence and mass forced displacement on population health (Camacho, 2008; Kreif *et al.*, 2022).

Since 2000, collaborative efforts between the United States and Colombian governments have aimed to combat the production and trafficking of drugs under Plan Colombia, a programme originally designed to improve the socio-economic instabilities in Colombia, but which rapidly evolved into a military initiative to address both drug trafficking and rebel-armed groups. In this counterinsurgency war against guerrilla movements, the security forces primarily targeted the FARC. The United States government spent close to $10 billion between 2000 and 2015 for Plan Colombia, whilst the Colombian counterpart disbursed over $85 billion during the same period (Figure 3).[8] During Álvaro Uribe's presidency (2002–10), the United States and Colombian governments merged drug enforcement with counterinsurgency operations to fight the FARC and regain state control of territory through military presence.[9] The paramilitaries, while maintaining close ties with drug trafficking, benefited from tacit support from the military, which strategically depended on them to maintain control of areas that the paramilitaries dominated. These circumstances also provided opportunities for the paramilitaries to increase their territorial and political influence by exploiting the vacuum left behind by the FARC who were targeted by Plan Colombia (Dube and Naidu, 2015).

The results of Plan Colombia on drug trafficking are controversial (Mejía, Restrepo, and Rozo, 2017), as cocaine production and violence remained high before the 2016 peace agreement, although certain types of violent crimes like kidnappings decreased substantially. Counterinsurgency operations might have improved healthcare provision, access, and governance through the reduction of drug trafficking and armed group

[8]Information about the United States security and defense assistance to Colombia was obtained from the Security Assistance Monitor (https://securityassistance.org/colombia). The yearly spending of the United States to reduce illicit narcotics and improve security reached $1.6 billion in 2008. For Colombia, data were collected from the Ministry of Defense.

[9]An estimated 15% of Colombian municipalities had no police presence before 2002 (GAO, 2008).

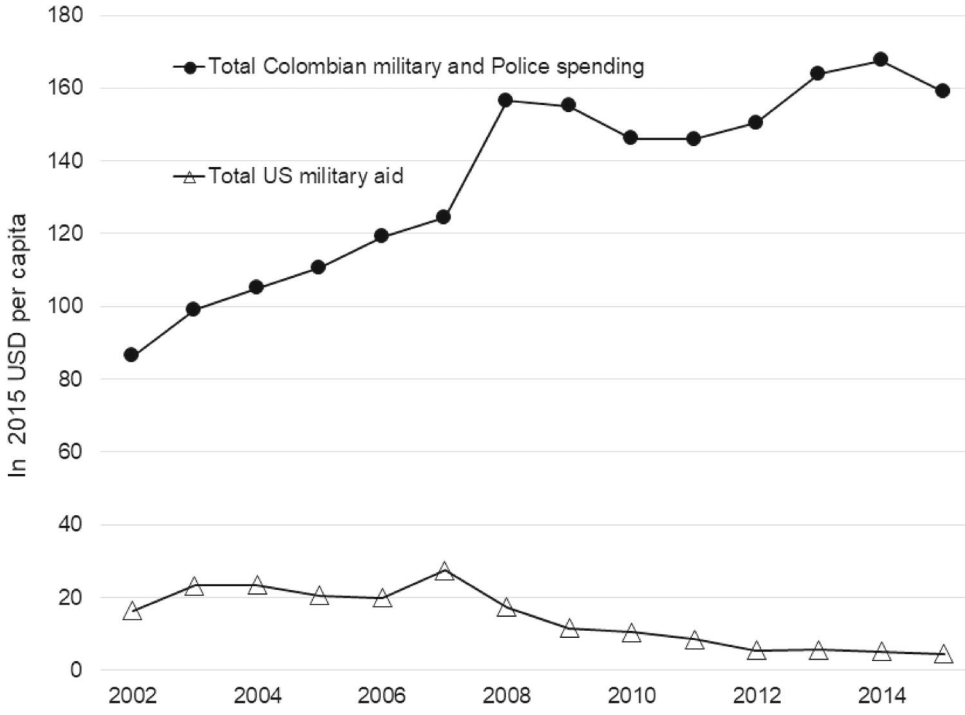

Figure 3. Evolution of the Colombian national military budget and US military aid assistance.
Notes: The graph plots the evolution of US military aid assistance (white triangles) and the total Colombian military and Police spending (black dots) in millions of 2015 US Dollars (USD) between 2002 and 2015. US military aid assistance corresponds to US funding for reducing illicit Narcotics and Improving Security, and was obtained from Security Assistance Monitor and supplemented with reports from the Congressional Research Service on Colombia. The US foreign security assistance was mostly devoted to military financing, equipment, training and counter-drug assistance. Data on Colombian Military and Police spending was obtained from the Ministry of Defense.

presence; but they might also have adversely affected access to public services (including health centres) and increased the local levels of conflict violence after the implementation of these counterinsurgency operations (Camacho and Mejía, 2017).

Cocaine seizure

Cocaine is obtained through a series of transformations between its harvesting from local farmers to its trafficking and trading in the international market (Umpierrez *et al.*, 2016). Farmers either directly sell coca leaves or transform them into coca paste through a chemical process that extracts coca from the leaf.[10] Coca paste is then traded among drug traffickers, transformed into cocaine hydrochloride in clandestine laboratories, and eventually smuggled into foreign countries.

Under Plan Colombia, the antinarcotics operations consisted of manual eradication, aerial spraying, seizures of drugs and precursors used in the transformation process of coca,

[10]Because it takes about one ton of coca leaf to produce 1 kg of coca paste, the latter form is more convenient for trafficking purposes. Coca is therefore often transformed into paste within coca-producing sites.

and the destruction of cocaine processing laboratories (GAO, 2008). Aerial eradication received by far the largest portion of the USA aid package. Yet, aerial spraying was specific to coca-producing regions and might not have affected the control of armed groups over the sprayed territory, leaving the level of exposure to violence unchanged among local populations.

III. Conceptual framework

We develop a simple conceptual framework that enables us to consider how the government may shape its decision to allocate its resources in conflict-affected territories, which we then use to motivate specific hypotheses to be tested in our empirical analysis. Consider that the government has control over the allocation of health resources to each municipality and can fully observe local needs in each municipality. Insurgents are present in some municipalities, and their characteristics are only partially observable. A rich literature has identified the channels through which counterinsurgency operations may lead to further violence (Kalyvas, 2006; Staniland, 2012; Dell, 2015; Dube and Naidu, 2015), including attacks against military (government) positions, threats against local populations to maintain fear and trust in rebels' military capacity, as well as increased tensions with other rebel groups or paramilitaries to maintain control over territory.

The effect of counterinsurgency operations on local public spending will depend on the strategic approach of the government between fighting insurgency, protecting civilians, and forging political stability. In this context, fiscal transfers may have double-edged implications: whilst fiscal transfers may be chosen to gain popular support and restore local development, they may also be prone to capture by the insurgents and increase their flow of resources.

We anticipate three (main) possible government strategies and related actions. First, the government could make an *ex-post* allocation decision through increased government fiscal transfers to address the potential health hazards following counterinsurgency operations. The government could reallocate resources to the affected populations, who may have experienced higher exposure to violence during the counterinsurgency operations. The additional funds may also serve to restore essential services that may have been interrupted or deteriorated and support economic and infrastructure development.

The second governmental strategy could be to allocate resources *ex-ante*, whereby fiscal transfers increase before the counterinsurgency intervention to gain popular support and establish cooperative relationships with local populations against insurgents. Under this strategy, the central government may decide to initially compete with insurgents by increasing state presence through additional provision of public goods, building civilian support, and cooperation against the insurgents. Another possibility is that the government might anticipate the surge in health needs and healthcare demand, and reallocate public health resources accordingly to mitigate long-term adverse health impacts.

A third possible governmental strategy entails *ex-ante* reduction of resources. Counterinsurgency operations could be preceded by a decrease in government fiscal transfers to cut the flow of resources to insurgents, before increasing transfers *ex-post* intervention to restore population health, economic activity, and state legitimacy. As local public revenues and spending might be prone to embezzlement, the central government

may have strong incentives to strategically reduce fiscal transfers to municipalities under rebel governance. The government may also reduce fiscal transfers to weaken local amenities and thereby local trust in the ability of rebels to provide adequate public services. This latter possibility might be the most plausible in the Colombian context between 2002 and 2015, where the capture of local resources and institutions by rebels and paramilitaries through changing property rights, and local tax rules, has been well documented (Eaton, 2006; Arjona, 2016; Ch *et al.*, 2018). For instance, local property institutions and tax performance are directly affected by the conflict through the presence of armed groups, and the use of land grabbing that plays in their favour. Affecting the pattern of local tax revenue through changes in intergovernmental transfers may then be an optimal strategy for the government to erode local support.[11] We further anticipate that during Uribe's presidency (2002–10), when the government used considerable force against civilians (Acemoglu *et al.*, 2020), the government's preferred 'tough stance' materialized into cuts to the flow of potential rebel resources, rather than the increase in fiscal transfers to gain popular support (Hazelton, 2017).[12]

Given the complex nature of the Colombian conflict, the plausibility of each of the three strategies above may be expected to vary depending on whether territories were under paramilitary, rebel, or state control. Similarly, healthcare provision and outcomes in some areas of the country could have been historically neglected by the central government, resulting in no specific strategy for health transfers in these areas in the presence of counterinsurgency operations. We address this issue directly in our heterogeneity analyses. Although data limitations do not allow us to test for the presence of each of the outlined possible governmental strategies individually, we can assess in our empirical analysis the combined net effect of these possible actions.

IV. Empirical strategy

Municipality fixed-effects estimation

The relationship between antinarcotics operations and the flow of government health transfers to municipalities can be described by

$$\Delta ln(HealthSGP_{mdt}) = \beta CocaSeizure_{mdt} + \vec{X}'_{mdt}\gamma + \alpha_m + \lambda_{dt} + \varepsilon_{mdt} \quad (1)$$

where $\Delta ln(HealthSGP_{mdt})$ denotes the growth rate of government health transfers to municipality m, department d and, year t. The variable of interest, $CocaSeizure_{mdt}$ measures antinarcotics interventions, captured by the quantity of cocaine seized in municipality m in year t. Since the distribution of cocaine seizure is highly skewed, with many municipalities reporting zero seizure, we transform the variable using the inverse hyperbolic sine function introduced by Johnson (1949). The function is similar to the

[11]This approach hypothesises that local populations may possess incomplete information about how local actors use public resources and any possible diversions.

[12]The three possible governmental strategies outlined are not mutually exclusive. It would be possible, for instance, that both strategies 2 and 3 are true but cancel each other out, in which case it would be challenging to identify the individual presence of these two strategies in our data.

natural logarithm transformation but is defined at zero.[13] As an alternative, we also use the logarithm transformation by adding 1 to coca seizure, and minimize the impact of this addition by expressing the variable in grams. The coefficient of interest, β, expresses the change, divided by 100, in the growth rate of health transfers associated with a 1% increase in antinarcotics interventions.

We argue that cocaine seizure should be a strong proxy for antinarcotics interventions. First, under Plan Colombia, data on the estimated kilograms of cocaine seized was one of the main indicators used to evaluate the performance of antinarcotics efforts, along with the hectares of coca eradicated (GAO, 2008). As mentioned in section II, cocaine paste, and hydrochloride are the two forms used for trafficking and distributing the drug in the illegal market. We exclude the seizure of coca leaf, as it reflects farmers' engagement in illicit farming rather than insurgent activities.[14] Second, under Plan Colombia, antinarcotics operations were largely assimilated into counterinsurgency efforts against the FARC (LeoGrande and Sharpe, 2000). To bolster our confidence that the quantity of cocaine seizure adequately captures counterinsurgency efforts, we provide empirical evidence, in section VI, that the variable has a statistically significant effect on the dynamic patterns of local violence.

The vector $\vec{X}_{mdt}$ denotes the vector of predetermined municipality characteristics that are thought to be correlated with both the outcome and the explanatory variable of interest, and interacted with year-fixed effects. The interactions with year-fixed effects address potential concerns that time-varying characteristics of municipalities could be correlated with the Colombian conflict. We control for the population enrolled in the subsidized regime in municipality m, since government health transfers primarily target those populations. We also control for the total population in each municipality, distance to the capital of the Department, a dummy variable equal to one for the presence of mineral or oil resources, and altitude. All the covariates are measured in 2001, except for population numbers, which are taken from the 1993 population census. We further address another concern that the government health transfers may be correlated with political cycles, by interacting a dummy equal to one during Uribe's presidency (2002–10) with the predetermined average of cocaine seizure, as well as an interaction between an indicator equal to one if the incumbent governor of the department belongs to the right-wing coalition party and the predetermined average seizure. Municipality fixed effects, α_m, account for time-invariant municipality characteristics, such as local administrative capacity. Since department governors have the political power to take decisions that affect various factors at the municipality level, we flexibly control for department-year fixed effects, λ_{dt}, to partial out any general yearly variations in health transfers that may vary across departments. We cluster standard errors at the municipality level.[15]

[13] In particular, $asin(x) = ln\left(x + \sqrt{x^2 + 1}\right)$. When x is large enough, the interpretation of the coefficient is similar to the logarithm transformation as it approximates as $ln(2) + ln(x)$. For this reason, also, the results are practically unaffected if we use the inverse hyperbolic transformation of our dependent variable SGP_{mdt}, and consider its growth rate.

[14] The production of coca leaf by farmers can simply result from the need for a livelihood. Seizing coca leaf might not directly threaten drug traffickers and influence conflict violence.

[15] In section VII, we show that all our baseline results are robust to double clustering at municipality and department-year level, which also accounts for spatial correlations within a department. However, our preferred

IV strategy

The main challenge in the estimation of β as the causal impact of antinarcotics operations on municipality health transfers is the potential endogeneity of these operations. Some omitted factors, such as financial downturns, could simultaneously reduce antinarcotics efforts and decrease public health spending through an overall reduction of the government budget, creating thereby a spurious correlation between the two variables. Additionally, the national government may prioritize drug enforcement efforts in municipalities with higher provision of public services to ensure that public resources are not controlled by non-state actors. This potential reverse causation could lead to an upward bias on our estimates. Another threat to the identification strategy is that healthcare needs might correlate with both antinarcotics operations and omitted time-varying municipality characteristics. Finally, measurement errors in the reporting of drug seizure could further threaten the correct identification of the causal effect of antinarcotics operations.[16]

Main instrument: shift-share instrument based on (world) US military aid

We build on recent econometric work on shift-share instruments (Adao, Kolesár, and Morales, 2019; Borusyak, Hull, and Jaravel, 2022), and exploit the fluctuations in world US military aid net of aid to Colombia, interacted with the predetermined municipality level probability of antinarcotics operations. US military aid is yearly requested by the US Administration and approved by the Congress, and aims to support countries strategically important to the US. Our motivation is to exploit fluctuations in the total US military aid as an exogenous source of variation in counterinsurgency operations (after subtracting aid to Colombia), while the probability of operations represents the share, or the importance, of drug enforcement policies in a particular municipality within the national context.[17]

We define $ProbaCoca_{md}$, the probability that an antinarcotics operation occurs in municipality m of department d based on the number of antinarcotics events between 1999 and 2003 in this municipality.[18] Precisely, we define the share part of our instrument as

$$ProbaCoca_{md} = \frac{1}{4} \sum_{Year=1999}^{2003} Coca_{mdYear} \tag{2}$$

regressions use one-way clustering. Although the two-way clustering can conveniently address correlations within department-year and municipality, the approach also presently lacks a clearly defined asymptotic theory (MacKinnon, Nielsen, and Webb, 2023).

[16]Measurement error of the dependent variable is less likely. Municipality health transfers are officially recorded by the central government and municipalities, and are arguably under more public scrutiny than antinarcotics operations.

[17]Our setting offers a particular case of shift-share instruments with a single national shock, but we leverage the panel structure of our data that has a relative long-time horizon and a high number of municipalities to ensure the consistency of the estimator (Borusyak *et al.*, 2022). Examples of studies that use a shift-share instrument in a similar setting (based on nationals shocks and regional variations) include Werker, Ahmed, and Cohen (2009), Nunn and Qian (2014) and Ahmed (2016).

[18]No data on cocaine seizure prior to 1999 was available for our study. Coca cultivation started to grow at a high rate in Colombia after 1998. We use data on cocaine seizure until 2003 to ensure that our constructed measure has enough variability. We follow Nunn and Qian (2014) and Ahmed (2016) who, in a different analytical context, proxy the probability of receiving aid by the average number of years that aid is received in the country over the sample period.

where *Year* is the index for the year of antinarcotics operations before 2003. We interact this measure with total US military aid:

$$ProbaCoca_{md} \times USmilitaryAid_t = \frac{1}{4} \sum_{Year=1999}^{2003} Coca_{mdYear} \times USmilitaryAid_t \quad (3)$$

where *USmilitaryAid* is the log of total US military aid net of aid for Colombia.

The first-stage equation is given by:

$$Antinarcotics_{mdt} = \delta(ProbaCoca_{md} \times USmilitaryAid_t) + \vec{X}'_{mdt}\gamma + \alpha_m + \lambda_{dt} + \nu_{mdt} \quad (4)$$

This shift-share instrument should capture the effects of the US government's pressure to reduce illegal drug trafficking in Colombia, with respect to the predetermined probability of antinarcotics interventions in municipalities. Since the exposure shares $ProbaCoca_{md}$, are fixed across years, the municipality fixed effects α_m capture time-invariant unobservable municipality characteristics of the instrument. As the sum of the probability of municipality antinarcotics interventions does not add up to one, we interact our department-year fixed effects with the sum of $ProbaCoca_{md}$ (Borusyak *et al.*, 2022). We expect that a growing amount of US military aid to the world would signal an increased willingness by the US administration to fight illegal drug trafficking and terrorism, and would trigger a higher incidence of counterinsurgency operations in Colombia through the USA–Colombian partnership Plan Colombia. Hence, we anticipate the coefficient δ to be positive.

Validity of our main instrument

Our identification strategy relies on the exogeneity of the interaction term $ProbaCoca_{md} \times USmilitaryAid_t$. Each shock of US military aid is assumed to be not only exogenous but also uncorrelated with the bias introduced by the predetermined probability of cocaine seizure. The validity of the instrument relies on the repetition of these exogenous shocks, which ultimately reduce the bias towards zero on average and, thereby, ensure the consistency of the interacted instrument (Adao *et al.*, 2019; Borusyak *et al.*, 2022). In particular, conditional on having non-zero probability of cocaine seizure in municipalities, shocks to US military aid should be quasi-randomly assigned and the probabilities of cocaine seizure across municipalities should be uncorrelated (Borusyak *et al.*, 2022).

The exclusion restrictions would be violated if, for instance, US military aid affects local government transfers through a change in total aid received in Colombia for development programmes, which would in turn induce a redistribution of public domestic resources. In our baseline specifications, we test for this possibility by controlling for total Official Development Assistance (ODA) received by Colombia interacted with the predetermined probability of cocaine seizure, and show that our results remain unaffected.[19] We address any remaining concerns and the overall validity of our instrument in section VII. Table A.1, in Appendix S1, compares the characteristics of municipalities involved in the

[19]ODA data were obtained from the OECD Creditor Reporting System database.

conflict in years with high and low US military aid, the latter being defined as above or below the median. If the empirical strategy is valid, we should not observe a correlation between municipality characteristics and the total US military aid net of Colombia. This is confirmed by the results in Table A.1, where the two sets of municipalities present balanced characteristics, except for the presence of oil and mineral resources which has a 3% higher probability in municipalities associated with high US military aid. We control for it in the subsequent analysis.

V. Data

Government health transfers and other variables

We collect information from the National Planning Department (NPD) on each government transfer SGP (health, education, water and sanitation, and general purposes) to municipalities. We further collect health transfer data disaggregated between the contributory and subsidized health insurance schemes from the Ministry of Health.[20] We also gather information on the population affiliated to each health insurance scheme from this same data source, as well as data on other government public transfers SGP to municipalities.

We supplement this data with information from the NPD on local public finances: expenditures, estimated municipality GDP, dependence on government transfers, debt, investment, municipality resources and saving capacity at the municipality level.[21] Additional information on municipality characteristics includes population, a rurality index, distance to the capital, number of health centres or hospitals in the municipality, and presence of oil and/or mineral resources; these are all obtained from the Centro de Estudios sobre Desarrollo Económico (CEDE) in the Facultad de Economía at the Universidad de Los Andes. The dataset covers all 1,098 Colombian municipalities between 2002 and 2015.[22] A peace agreement was signed between the FARC and the Colombian government in 2016, and agreements to de-escalate the conflict with ceasefires already started in 2015. Counterinsurgency efforts were substantially reduced, and the intensity of conflict radically changed after 2016, although some remote acts of violence may have persisted in the country.

Explanatory variable: antinarcotics operations

We capture antinarcotics operations through the quantity of cocaine seized in municipalities, collecting yearly data on the quantity of illicit drugs seized in a municipality from the National Police of the Ministry of Defence and the *Observatorio de Drogas de Colombia*. Since the decisions about conducting antinarcotics operations are entirely

[20]The data are obtained from *Sistema Integrado de Información de la Protección Social* (Integrated information system of social protection, SISPRO).

[21]The estimation of municipality GDP is produced by the NPD using municipal budget execution.

[22]The total number of municipalities in Colombia has slightly increased over the sample period to reach 1,222 in 2015, due to the division of some municipalities and the rearrangement of their administrative boundaries. To work with a balanced panel and track all municipalities over the sample period, our analysis excluded these newly created municipalities.

planned and carried out by the National Police of the Ministry of Defence, the level of counterinsurgency efforts (as defined in our work) is solely set by the Colombian central government.

We create a coca seizure variable that combines the yearly seizures of the two forms of cocaine used for trafficking and distributing the drug in the illegal market: cocaine paste and hydrochloride.

US military aid

Our main instrument uses information on total US Foreign Military Financing (FMF) net of Colombia, collected from the archive of the US Department of State. FMF corresponds to grants or direct loan funding provided to a foreign government, in any fiscal year, for the purchase of US defense articles, services, construction projects and training. FMF is yearly requested by the US administration and approved by the Congress. The Department of State defines the objectives of the programme as 'to promote US national security by contributing to regional and global stability, strengthening military support for democratically elected governments and containing transnational threats, including terrorism and trafficking in narcotics, weapons, and persons.' The share of FMF allocated to Colombia ranged from 0.5% to 2.5% between 2002 and 2015 (Figure A.1 in Appendix S1).

VI. Results

First-stage relationship with the shift-share instrument

Figure A.2 in the Appendix S1 provides a visualization of the geographical distribution of the predetermined probability of antinarcotics operations over the 1999–2003 period. We classify the distribution of the probability of interventions by quintile. The figure illustrates that the densely populated urban municipalities (in the diagonal centre of Colombia) are less likely to be affected by antinarcotics operations than remote rural municipalities (in the south and north).

Table 1 reports the coefficient estimates on the interacted instrument from the first-stage equation (4), along with the Kleibergen–Paap (KP) F-statistic. Column (1) includes municipality and year fixed effects, as well as the share of those enrolled in the subsidized regime, and column (2) adds the baseline controls described in the previous section. Adding the baseline controls leads to a high F-statistic and increases the coefficient of the instrument. From columns (3) to (5), the inclusion of department-year fixed effects reduces the coefficient estimates on the instrument and its predictive power, but the instrument remains significant. The coefficient on the instrument almost doubles in magnitude from columns (1) to (3) as we control for the baseline covariates and municipality and department-year fixed effects. We apply the methodology developed by Oster (2019) to examine how the inclusion of controls affects the coefficient of the instrument and the R-squared. The δ parameter reported in columns (2) and (3) is above the minimum recommended absolute value of 1, thus indicating limited scope for unobservable factors to explain our results.

TABLE 1
First-stage: validity of the main instrument.

	(1) Municipality FE	*(2) Controls+ FE*	*(3) Controls+ Depart-Year FE*	*(4) Excluding weak states*	*(5) Falsification test*
Dependent variable	asinh(Coca seizure)				
ProbaCoca × US Military Aid	5.6318***	7.0521***	9.7280***	7.8284***	
	(1.0330)	(1.0842)	(1.3202)	(1.2964)	
ProbaCoca × US Military Aid (t+1)					0.0005
					(0.0003)
Oster δ for $\beta = 0$		-2.39	-2.99		
Kleibergen–Paap F-statistic	29.72	42.30	54.30	36.46	2.01
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No	No
Department-year FE	No	No	Yes	Yes	Yes
Share subsidized regime	Yes	Yes	Yes	Yes	Yes
Baseline controls	No	Yes	Yes	Yes	Yes
Observations	14274	14274	14274	13468	13176
Municipalities	1098	1098	1098	1036	1098

Notes: The table presents the first-stage results from equation (4) where the dependent variable is antinarcotics operations capture by the IHS transformation of the cocaine seizure variable. The main explanatory variable is the interaction between the predetermined probability of cocaine seizure ($ProbaCoca_{md}$) and total US military aid (columns (1)–(4)). Column (5) presents a falsification test with the instrument based on the interaction between the probability of cocaine seizure and the lead of the total US military aid variable. The δ parameter from Oster (2019), which corresponds to the relative importance of unobservables to observables, is reported for Columns (2) and (3) to analyse how the inclusion of controls affects the coefficient of the instrument and the R-squared. The standard errors are clustered at the municipality level. *, ** and *** indicate significance at the 10%, 5% and 1%, respectively.

Despite our above discussion on the plausibility of the exogeneity of total US military aid, one might still be worried about possible unobservable factors that could steer public resources away from municipalities implicitly targeted by US military aid, or conversely attract such resources. In years when the total US budget for military aid is high, the Colombian government may systematically decide to divert public resources from municipalities with weak state presence. In column (4) of Table 1, we check this possibility by testing whether our results are robust to excluding municipalities from the departments that were historically known for hosting insurgents, where the majority of coca cultivation took place and where the state had little presence during the 2002–15 period (Putumayo, Caqueta, Guaviare and Meta). The coefficients remain very stable and highly significant, indicating that the effects are not driven by municipalities with a comparatively higher rebel presence, and they also provide reassurance about the validity of our identifying assumption.

Finally, the results could be confounded by time-varying unobserved variables that would affect US military aid and fiscal transfers despite the use of our fixed effects. We address this concern and provide a falsification test in column (5), where we use the interaction between the probability of cocaine seizure and the lead of total US military aid (at t+1) to predict past antinarcotics operations in Colombia. Finding a significant effect would be counterintuitive, since a priori, the Colombian government is unlikely to set its level of counterinsurgency efforts based on its anticipation of the total military aid budget that will be requested by the US Administration and approved by the US

Congress. Reassuringly, the coefficient is statistically insignificant and close to zero, thereby supporting the suitability of focusing on total US military aid as an exogenous source of variation in antinarcotics operations.

Health transfers

Table 2 provides summary statistics for all key variables used in the analysis at the municipality level. It shows that the municipality health transfers grew by 3% on average during the study period. The average probability that a municipality hosts an antinarcotics operation in a given year is 17%, but large disparities exist across municipalities in Colombia, as highlighted in Figure A.2 in Appendix S1.

Table A.2 reports the baseline estimates for the effect of antinarcotics operations on government health transfers. We report the estimates of the coefficient of the cocaine seizure variable using the Inverse Hyperbolic Sine (IHS) and show that the results are quantitatively similar to the log-transformation presented in the Table A.2 in Appendix S1. In Appendix S1, we further establish the robustness of the results to alternative definitions of antinarcotics operations, by using an indicator variable equal to one if cocaine seizure is above the 75th percentile of the distribution (Table A.3), by using only cocaine paste and dropping hydrochloride, the other form of cocaine used for trafficking (Table A.4), and when changing the unit of cocaine seizure, from grams to micrograms (Table A.5). Table 3 indicates that the results are qualitatively unaffected, albeit the KP F-statistics are different. Panel A reports the results from the fixed-effect (FE) estimation of equation (1) which do not account for the potential endogeneity of antinarcotics operations. Column (1) controls for municipality and year fixed effects, and the share of subsidized regime to provide a benchmark, column (2) fully controls for the baseline covariates and column

TABLE 2

Summary statistics.

	Mean	*SD*	*Min*	*Max*	*Obs.*
Panel A. Main outcomes					
Growth rate(SGP − health)	0.03	0.15	-3.68	3.60	13,176
Panel B. Controls					
asinh(Cocaine seizure)	4.57	5.15	0.00	18.36	14,274
ln(Cocaine seizure+1)	4.22	4.86	0.00	17.66	14,274
ln(Subsidized regime pop. in 2001)	8.70	0.86	0.00	14.07	14,274
ln(Population in 1993)	9.54	1.06	6.70	15.69	14,274
ln(Municipality GDP in 2001)	11.68	1.27	8.07	18.75	14,261
Governor right party (dummy)	0.05	0.17	0.00	1.00	14,274
Distance to capital of Department in km	78.92	56.07	0.00	376.12	14,274
Oil and Mineral resources (dummy)	0.10	0.30	0.00	1.00	14,274
Altitude	1,142.70	902.29	2.00	3,087.00	14,274
Panel C. Instruments					
Probability coca seizure (1999–2003)	0.17	0.28	0.00	1.00	14,274
ln(US Military Aid)	8.66	0.12	8.50	9.01	14,274

Notes: All statistics are reported at the municipality level. Panel A presents the dependent variables that are used in the analysis, Panel B presents the baseline controls and Panel C shows the statistics for the variables that are used in the construction of the instrument variable. All variable definitions and data sources are provided in section A in Appendix S1.

TABLE 3
The effect of antinarcotics interventions on public health transfers.

	(1)	*(2)*	*(3)*	*(4)*
	Dependent variable: Δ*ln*(*HealthSGP*)			
Panel A: OLS estimation				
asinh(Coca seizure)	0.0007	0.0005	0.0006	0.0006
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Panel B: Reduced form estimation				
ProbaCoca × USmilitaryAid	0.0443	-0.0495	-0.0221	-0.0217
	(0.0290)	(0.0312)	(0.0356)	(0.0355)
Panel C: 2SLS estimation				
asinh(Coca seizure)	0.0077	-0.0069	-0.0022	-0.0022
	(0.0052)	(0.0044)	(0.0036)	(0.0037)
ProbaCoca × Total ODA				-0.0014
				(0.0119)
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No
Department-year FE	No	No	Yes	Yes
Share subsidized regime	Yes	Yes	Yes	Yes
Colombian president × ProbaCoca	No	Yes	Yes	Yes
Right Governor × ProbaCoca	No	Yes	Yes	Yes
Municipality characteristics × year FE	No	Yes	Yes	Yes
Observations	14,274	14,274	14,274	14,274
Municipalities	1,098	1,098	1,098	1,098
Panel D: First-stage estimation				
Dependent variable	asinh(Coca seizure)			
ProbaCoca × USmilitaryAid	5.7761***	7.1635***	9.8829***	9.7280***
	(1.0374)	(1.0876)	(1.3218)	(1.3201)
Kleibergen-Paap *F*-statistic	30.99	43.38	55.91	54.3
Controls as in panel A	Yes	Yes	Yes	Yes

Notes: FE estimates are obtained from equation (1) and reported in Panel A, while reduced form and 2SLS estimates are reported in Panels B and C. *USmilitaryAid* is the natural log of US military aid net of aid for Colombia. Additional controls include distance to capital, distance to oil and/or mineral resources, altitude, municipality GDP, population, and enrolled in the subsidized regime, all interacted with time dummies. Standard errors are below each estimate in parentheses and are adjusted for clustering at the municipality level. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

(3) adds the department-year fixed effects. The FE estimates suggest a small, positive, but statistically insignificant correlation between the government health transfers and antinarcotics operations once we control for the main covariates. Panel B reports the reduced-form estimates.

Panel C of Table 3 reports the second-stage of the two-stage least squares (2SLS) estimates in panel A and their corresponding first-stage estimates in panel D. The coefficients on antinarcotics operations are again small but negative, and controlling for department-year fixed effects further reduces the 2SLS estimates. In panel D, the KP *F*-statistic for the excluded instrument is above 40 when we fully control for the covariates in column (2), and raises above 55 when controlling for department-year fixed effects, suggesting that the instrument remains a strong predictor of cocaine seizure. The

results indicate a strong positive correlation between the interaction of the predetermined probability of cocaine seizure with total US military aid excluding Colombia, and cocaine seizure. Specifically, a 1% increase in both the probability of cocaine seizure and total US military aid increases cocaine seizure by almost 10%. Column (4) tests the possibility that total US military aid indirectly affects public health transfers through a change in the flow of US aid resources allocated to Colombia (ODA). The statistically insignificant coefficient on the interaction between the predetermined average probability of cocaine seizure and total ODA suggests that this particular channel should not play a meaningful role in the allocation of health resources.

The magnitudes of the coefficients on cocaine seizure are smaller with the 2SLS specifications than with the FE models, and statistically insignificant across specifications. Whilst the endogeneity of cocaine seizure (and its reverse causality) induces an upward bias in the FE estimates, additional sources of bias may contribute to the difference in the coefficient estimates. One possibility is measurement error in the cocaine seizure variable that could further overstate the true effect, whose sources could include: (i) under-reporting of cocaine seizure, both in terms of quantity and frequency, by police and military officials; (ii) the fact that combined data may become inaccurate or outdated once centralized by the Ministry of Defence, if there exist discrepancies between the data held by the municipalities and the information transmitted to the central government.[23] Another likely explanation for the difference between FE and 2SLS estimates is that the latter are capturing a local average treatment effect (LATE). Antinarcotics interventions may have a differential effect among municipalities with frequent interventions (complier municipalities), compared to municipalities with a lower probability of hosting an operation but with a potentially higher quantity of cocaine seized. For example, complier municipalities might be under closer watch of the government than non-complier municipalities. We control for municipality characteristics, such as distance to the capital or whether the municipality hosts oil or mineral production sites, and interact them with year fixed effects. Nonetheless, other unobservable characteristics might correlate with the government's closer attention to particular municipalities, which in turn might be correlated with health transfers.

The magnitudes of the OLS estimates suggest that increasing antinarcotics operations in a given municipality from 0 to the 50th percentile of the sample (a 3.0-kg increase in coca seizure) leads to a rise in the growth rate of municipality health transfers of $\ln(3000) \times 0.007 = 0.032$ %, when fully controlling for the baseline covariates with year fixed effects, and a fall of $\ln(3000) \times 0.003 = 0.016$ % with the 2SLS estimates. These results are both quantitatively small and statistically insignificant and suggest that health transfers are not systematically affected by antinarcotics operations.

VII. Treatment effect heterogeneity and robustness

First, we explore the possibility that health transfers are allocated differently to municipalities in the upper tail of the distribution of antinarcotics interventions. For

[23]Measurement errors could correlate with department and municipality characteristics, such as administrative capacity or corruption. By controlling for municipality and department-year fixed effects, we expect to account for most of this potential correlation.

example, the central government could identify municipalities where rampant drug trafficking and violence by illegal armed groups is high and which would be perceived to require sustained transfers of resources for health, security and other public functions. To test this hypothesis, we split our sample into deciles over the 2002–15 period and estimate the following regression

$$\Delta ln(SGP_{mdt}) = \sum_{i=1}^{i=10} \beta_{1i} Antinarcotics_{mdti} + \vec{X}'_{mdt}\gamma + \alpha_m + \lambda_{dt} + \epsilon_{mdt} \quad (5)$$

where i indexes the deciles in the distribution of the probability of antinarcotics operations, the rest of the notation being similar to equation (1).

We first present the main pattern of correlation between antinarcotics operations and the growth of health transfers. Figure A.3 in Appendix S1 plots the growth rate of health transfers, residualized with respect to cocaine seizure and all baseline controls, against antinarcotics operations. The graph presents visual evidence of an absence of correlation throughout the distribution. Next, Figure A.4 in Appendix S1 plots the coefficients on the antinarcotics operations variable for each decile (β_{1i}), along with their 95% confidence intervals. The figure documents a similar effect of antinarcotics operations on the growth rate of health transfers across deciles, where each coefficient is insignificant and tightly centred around zero.

We start by investigating the possibility that increased transfers are systematically unreported due to higher corruption in municipalities where drug enforcement operations are conducted, which might lead to lower estimated treatment effects for the municipalities with higher levels of corruption. Columns (2)–(3) in Table 4 explore this opportunistic behaviour hypothesis. In Colombia, the Inspector Attorney General's Office (*Procuradurta General de la Nacton*, PGN) is an independent and autonomous public agency in charge of monitoring the use of public resources, the behaviour of public officers and investigating allegations of human rights abuses committed by security forces. We use data collected by Martínez (2023) from the PGN on the prosecutions of mayors and local municipal officials for suspected involvement in corruption, to construct an indicator variable equal to one for each year when a prosecution is being conducted in a municipality. The interaction term with prosecution captures the differential effect of antinarcotics operations in municipalities with suspected cases of corruption, with respect to municipalities with no such cases. The estimated coefficient is negative but with a small magnitude and statistically insignificant.

Next, we test for the possibility of heterogeneous effects of antinarcotics operations according to municipalities' characteristics. We construct a series of municipality-level indicators I_{mdt} for being above the sample median of the variable of interest. In each regression, we instrument the interaction between the indicator and antinarcotics interventions with a triple interaction between the probability of cocaine seizure, total US military aid and the indicator of interest, and we add a separate interaction term between US military aid and the indicator.

Columns (4)–(7) of Table 4 report the estimates of the coefficients on the interaction terms with the following financial characteristics: debt, dependence on government transfers, the municipality's own resources (i.e. local taxes and fees), and saving capacity.

TABLE 4

The heterogeneous effect of antinarcotics interventions on public health transfers.

Panel A: Panel data estimation							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: $\Delta ln(HealthSGP)$						
Model	2SLS						
asinh(Coca seizure)	-0.0022	-0.0019	-0.0048	-0.0026	-0.0033	-0.0006	-0.0033
	(0.0036)	(0.0036)	(0.0035)	(0.0037)	(0.0036)	(0.0035)	(0.0036)
asinh(Coca seizure)							
× Prosecution		-0.0011*					
		(0.0006)					
× Prosecution (lagged t-3)			-0.0001				
			(0.0006)				
× Debt				-0.0005			
				(0.0005)			
× Dependence government transfer					0.0001		
					(0.0005)		
× Municipality own resources						0.0001	
						(0.0007)	
× Saving capacity							0.0001
							(0.0004)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,274	14,274	13,176	14,171	14,171	14,171	14,171
Municipalities	1,098	1,098	1,098	1,097	1,097	1,097	1,097
Panel B: First-stage of the corresponding 2SLS panel regressions							
Kleibergen–Paap *F*-statistic	55.91	18.64	21.56	17.49	17.76	19.21	17.91

Notes: All results are 2SLS estimations in panel A and *F*-stat of the first-stage regressions in panel B. Baseline controls are those presented in Table 3. The instrument used is the interaction between the probability of coca seizure and total US military aid. Dependence on government transfers is defined as the share of government transfers in total public spending. Municipality own resources refers to the capacity of a municipality to generate its own revenue out of total public spending. Saving capacity is equal to the difference between public revenue and spending out of total spending. Prosecution (lagged t-3) is a dummy variable equal to one in periods t-3, t-2 and t-1 if a suspected case of corruption occurs in year t. Standard errors are below each estimate in parentheses and are adjusted for clustering at the municipality level. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

We do not find evidence that any effects of antinarcotics interventions on health transfers could operate through these channels.

Robustness

In section D in Appendix S1, we conduct extensive tests to demonstrate the robustness of our findings. We start by demonstrating that, given our sample size and the expected effect on population health, our analysis should have enough statistical power to detect changes in health transfers that would lead to meaningful effects on health. We then address potential concerns of omitted variable bias in equation (1) that could arise if the growth rate of past municipality health transfers continues to affect the growth rate of contemporaneous transfers.

Another concern may arise if antinarcotics operations are more likely to affect the growth rate of transfers in the next period rather than in the contemporaneous period. In Appendix S1, section D.3, we present results that do not suggest any anticipation or delayed strategic response by the government.

We next present evidence of the stability of the results across the study period. Figure A.5 in Appendix S1 plots the coefficients on the interaction term between antinarcotics operations and yearly dummies obtained from our baseline 2SLS models, revealing positive but insignificant effects between 2003 and 2015. Specifically, the coefficient estimates appear very stable and we do not find evidence that the change from Uribe to Santos as Colombian president in 2010, or the regional and municipal elections every 4 years between 2003 and 2015, affect our baseline results.

In our baseline specifications, standard errors are clustered at the municipality level. We establish the robustness of the results to using alternative assumptions about the structure of the error term. In Appendix S1, Table A.6 reports the baseline results with standard errors corrected for two-way clusters at the municipality level and at the level of department in each year. In this way, we can account both for correlation within a municipality over time and for spatial correlation within a department-year. Table A.7 tests the robustness of the results to correcting standard errors for spatial correlation following Conley (1999) and Colella *et al.* (2019). We report the standard errors corrected for spatial correlation of the error terms within 100 and up 1,000 km. In all cases, the estimated effect remains statistically insignificant.

For completeness, we also consider the effect of political party on antinarcotics operations and health transfers. We restrict our sample to municipalities where the right-wing mayor from the right coalition party won by a large margin ($>-10\%$). Municipalities where mayors are politically aligned with the government and have a relatively large support from their constituency could facilitate drug enforcement policies. Table A.8 in Appendix S1 shows that even in cases with political alignment, the results remain qualitatively similar in the presence of antinarcotics operations. This last result contrasts with the finding on the manipulation of health transfers for political motives (section C.4 in Appendix S1) and suggests that during counterinsurgency efforts, political factors no longer play a role in the allocation of health resources.

We further notice a large number of zeroes in the antinarcotics operations variable, with the remaining non-zero observations having a skewed distribution. This raises the

possibility that there might be two distinct mechanisms at play: one that determines whether a municipality hosts any antinarcotics interventions, and conditional on hosting them, the frequency of the antinarcotics operations. To account for the potential endogeneity issue, we adopt a control function approach for nonlinear instrumental variable estimation (Wooldridge, 2014), where we model the untransformed endogenous variable as a two-part model (section D.4 in Appendix S1). Our baseline results remain robust to this alternative approach.

We also explore whether our results are sensitive to excluding municipalities from the departments where the state had little presence during the 2002–15 period (Putumayo, Caqueta, Guaviare, and Meta), as we could expect fewer public resources to be allocated to these departments by the central government. Table A.9 in Appendix S1 presents the FE and 2SLS estimates from our baseline specifications with the exclusion of the departments cited above (comprising 62 municipalities). The results are qualitatively identical to our baseline results.

Another concern is that our measure of antinarcotics operations based on cocaine seizure could bias our results if some municipalities consistently report high levels of seizure because of their specific transport infrastructure that facilitates illegal trafficking. We establish robustness to excluding municipalities with major ports (Cartagena, Santa Marta, Tumaco, Buenaventura and Barranquilla) and international airports (Medellín and Bogotá), where drug seizure could be particularly high without implying a high level of counterinsurgency efforts. In the Table A.10 in Appendix S1, we report the results of FE and 2SLS specifications and show that the results are qualitatively similar to our baseline estimates.

We further investigate whether antinarcotics operations trigger a response from the central government via other intergovernmental transfers (Table A.11). The central government may choose to mitigate the effect of antinarcotics operations on population health and well-being through other general public transfers to municipalities. We also explore whether some subcomponents of health transfers are differentially affected by counterinsurgency efforts (e.g. transfers for public health, subsidized regime and health services). Overall, our results indicate the absence of any significant effect on the subcomponent of health transfers and other transfers, except for education. Further analysis of this effect points to an ambiguous governmental strategy on the education channel that may leave the areas most intensely exposed to violence without any additional resources.

Together, the results of these tests remain qualitatively identical to our baseline estimates and demonstrate their robustness to the measurement strategy.

Finally, we verify in our data whether counterinsurgency effort affects local violence, and find a strong significant effect of antinarcotics operations on the dynamics of local violence (Table A.12). This last finding corroborates the existing literature and provides support for the argument that health resources should be adequately adjusted.

VIII. Discussion and conclusion

Protracted internal conflicts have become common in recent decades, affecting low- and middle-income countries disproportionally. The consequences for health and development

have been devastating: beyond the widely documented negative consequences of sustained conflict violence for the health of local populations (Levy and Sidel, 2016; Bendavid *et al.*, 2021), health and welfare may be affected in the longer term by destruction of economic assets, damage or lack of access to public healthcare and other infrastructure, shortages of supplies, medication and health personnel (Ramos Jaraba *et al.*, 2020), and population displacements (Justino, 2006). Understanding the dynamics of public healthcare responses amid conflict violence is therefore critical to guide public policies that can promote the health and economic recovery of conflict-affected areas and their populations.

This paper offers novel evidence about local public financing responses during periods of increased violence stemming from government military actions against insurgent groups. We examine how intergovernmental transfers, particularly those devoted to health, are affected by antinarcotics interventions aimed at disrupting the funding sources of insurgent groups at the municipality level. We use panel data on all municipalities in Colombia over a 14-year period of the conflict marked by intense counterinsurgency activities. We find no evidence of systematic changes in the allocation of local public health resources as a response to, or accompanying, antinarcotics operations implemented in Colombian municipalities. We find that antinarcotics operations in a given municipality do not causally affect intergovernmental transfers to the same municipality, either contemporaneously or in a lagged fashion. These results are supported by various pieces of evidence.

We make two main contributions to the broader literature on civil conflict and population health. First, our findings support the idea that governments do not integrate any decisions about changing the allocation of public resources, and thereby the provision of public goods, into their strategies to fight insurgency. Even though the government could, in principle, use alternative public policies to mitigate the adverse population effects (including on health) of counterinsurgency operations, the absence of a fiscal response in a context where central transfers constitute the main source of local healthcare financing raises serious concerns about the capacity of the government to address the unintended health consequences of the conflict and protect population health. This finding contradicts the argument that governments may seek to win 'hearts and minds' through increased provision of public goods, which in turn increases the efficiency of counterinsurgency operations (Berman *et al.*, 2011). Governments may fear that rebels will engage in strategic looting and reinforce their own legitimacy and local authority. Therefore, the priority governmental strategy may be a tough military approach to regain territorial control, as opposed to other alternatives aimed at restoring the social contract between the state and the local community (Hazelton, 2017). The central government may then choose alternative ways to increase its local influence, such as through increasing the presence of police officers or judges.

Second, our findings indicate that intergovernmental transfers to local governments are not used as a way of eroding local support for the presence of illegal armed groups. We show that political outcomes did not affect fiscal transfers, even with the highly politicised nature of the Colombian conflict. We interpret these results as suggestive evidence that the government may not use intergovernmental transfers as the primary channel to influence its local authority. Lastly, the lack of institutional capacity across municipalities might

further deter any incentives to increase fiscal transfers to conflict-affected regions (Besley and Persson, 2008).

Although our main conclusion above has emerged from the analysis of a richer dataset at the subnational level, it is consistent with the findings of the cross-country study by Gupta *et al.* (2004), who point to increased government spending during armed conflicts but one which is directed primarily to the defence sector (and financed through higher public deficit), whilst spending on social sectors like health remains generally unchanged. As Gupta *et al.* (2004) and Blattman and Miguel (2010) have suggested, increased levels of conflict-related violence are likely to have negative impacts on local economic growth and public revenues, therefore reducing the fiscal space available for expanding health financing when the government's priority is shifted towards defence spending. In the context of our study, this would indicate that the substantial additional resources obtained under Plan Colombia have been dedicated to enhancing the state's capacity to undertake counterinsurgency operations (i.e. primarily its defence budget), while not releasing resources for other public areas of spending and, more specifically, not addressing the issue of enabling a health safety net for the civilian populations affected by the increased violence stemming from such operations.

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Supporting Information

Additional Supporting Information may be found in the online Appendix:

Appendix S1. Supporting information

Data replication package: the data replication package is available at https://doi.org/10.3886/E188961