CIVIL WARS
https://doi.org/10.1080/13698249.2023.2242750

Routledge
Taylor & Francis Group

Farming to Fighting: How Shifting Agricultural Incomes Only Impact the Most Powerful Rebel Group

Phillip Nelson

Department of Politics and International Studies, University of Warwick, Coventry, UK

ABSTRACT

Recent research into the relationship between agricultural income and conflict has revealed sub-national geographic variation in the relationship. But many governments fighting rebellion are involved in more than one conflict simultaneously. This paper engages in a sub-national analysis of Colombia, utilising data on coffee income and violence across two individual rebel groups, to argue that the relationship between shifts in agricultural income and conflict holds only for the strongest group in a conflict region. This is explained by considerations of opportunity cost, a proposition tested in an analysis of competing mechanisms. Results show strong support for the propositions.

ARTICLE HISTORY Received 4 November 2022; Accepted 27 July 2023

The relationship between economic development and civil conflict is one of the most robust in civil war literature (Hegre and Sambanis 2006). In general terms: as incomes fall, conflict becomes more likely. Well-established explanations of this relationship include opportunity costs and state capacity (Collier and Hoeffler 1998, Azam 2001, Fearon 2003, Nelson 2021). However, recent research on Africa has suggested that agricultural income alone may be a better indicator of conflict risk (Fjelde 2015). Further research has revealed sub-national geographic variation in this relationship (Raleigh and Kniveton 2012, McGuirk and Burke 2016, Crost *et al*. 2018, Guardado and Pennings 2020). Yet, works to date have focussed on total levels of violence in a given region, which might overlook the potential for shifting agricultural incomes to affect different rebel groups heterogeneously. Research into recruitment practices and various conflict outcomes might suggest we should expect shifting agricultural incomes do not impact all groups equally (Weinstein 2005). Thus, this paper seeks to answer the question: which rebel groups are most likely to be affected by a fall in agricultural income, and why?

CONTACT Phillip Nelson Phillip.nelson@warwick.ac.uk
Supplemental data for this article can be accessed online at https://doi.org/10.1080/13698249.2023.2242750.

This paper seeks to answer these questions by proposing that the relationship holds only for the strongest rebel group in a conflict zone. Given a fall in agricultural income and resulting considerations of opportunity costs, farmers considering the option of joining a rebel group will select an organisation that offers the best benefits. The most powerful group will have a clear advantage in being able to credibly make such promises. By attracting a new glut of recruits, the most powerful group will be able to expand its conflict activity, while less powerful groups will not. This study tests the proposition by comparing the effect of changing agricultural income on conflict outcomes for two rebel groups in Colombia from 1989–2005. It further tests the mechanism of opportunity cost with data on wages and hours worked, comparing this to potential grievance factors in placebo tests. Support is found for both the primary proposition and the mechanism of opportunity costs. No support is found for grievance factors as an alternative explanation in the Colombian case.

Colombia has been experiencing internal armed conflict for almost 60 years, with multiple armed insurgent groups operating simultaneously across the majority of the country. Colombia can be considered a 'typical' case in which to find evidence of the relationship between agricultural incomes and conflict due to previous findings (Seawright and Gerring 2008, Dube and Vargas 2013). This paper uses a typical case to delve beneath the national level to examine the influence of shifting agricultural incomes on distinct rebel groups. Systematic data on the Colombian conflict has been gathered for many years. This paper uses two alternative sources of conflict data to verify its findings – one internal and one external to Colombia. Agricultural incomes will be measured using coffee income – a key source of earnings in the Colombian agricultural industry.[1]

The key contribution of this paper is thus the proposition of a primary scope condition for the relationship between farming and fighting. Results suggest it is time to move beyond examinations of aggregate conflict variables to consider unique impacts on individual conflict groups (Collier and Hoeffler 1998, Fearon and Laitin 2003, Fjelde 2015, Nelson 2021). This approach presents a multitude of opportunities to examine the true drivers of aggregate relationships, something that continues to be debated at the aggregate level but which may never be convincingly concluded with analyses at such levels (De Soysa and Fjelde 2010, Mousseau 2012, Jakobsen *et al*. 2013, Chatagnier and Castelli 2019). Beyond work on the relationship between economic development and conflict, this work also speaks to emerging literature on climate change and conflict (Hendrix and Glaser 2007, Jun 2017, Van Baalen and Mobjörk 2018, Koubi 2018). With more frequent instances of extreme weather, the pressure placed on agricultural incomes and potential conflict risk is abundantly clear.

Finding that only dominant groups will be likely to start more hostilities, combined with evidence to support opportunity costs as the key driver of this relationship, suggests that governments should do all in their power to offset agricultural incomes when international prices dip if they wish to diminish the incentives for individuals to partake in rebellion and minimise the potential power of their primary rival.

Economic Development and Civil Conflict

Collier and Hoeffler (1998) are the first to argue that an increase in average income levels (as proxied by GDP) results in a reduced propensity toward civil conflict as the increase in income reflects an increase in the opportunity cost of rebellion for all potential rebel agents.[2] The theory states that income levels or wages can be directly compared between the professions of rebellion and any other legitimate occupation. Agents engaged in a cost-benefit analysis will choose the option that maximises their utility. If wages in the productive economy are high, the opportunity cost of becoming a professional rebel will be equally high. This theory has become extremely prominent in the literature as the go-to explanation of the link between income levels and conflict (Miguel *et al*. 2004, Besley and Persson 2008, Dube and Vargas 2013, McGuirk and Burke 2017). However, not all income may be equally linked with conflict, and could even have an opposite effect – making violence more likely.

Based on the contest model literature (Grossman 1991, 1995), Azam (2001) argues that as the 'size of the prize' increases the likelihood that humans will fight to obtain it also rises. This 'rapacity' theory has been particularly prominent in explaining conflict over and attempts to control high-value resources such as precious metals, stones, and narcotics (see e.g., Dube and Vargas 2013).

In both cases, wealth has been measured in previous works with changes in the level of average income (GDP). This aggregate measure is unable to reveal whether certain incomes are more peace inducing than others. Some work on international commodity prices and conflict has tried to move beyond GDP as a measure of this relationship. Besley and Persson (2008), for example, use commodity prices to show that an increase in incomes is related to an increase in the risk of conflict, while Brückner and Ciccone (2010) find the opposite. However, neither of these studies distinguishes between agricultural and other commodities. Dal Bó and Dal Bó (2011) suggest that commodities will affect conflict in different ways based on the labour-intensivity of their production: a rise in income from labour-intensive commodities will reduce conflict and vice versa for capital-intensive products. Bazzi and Blattman (2014) empirically test the impact of price fluctuations in different commodity groups on the risk of

conflict, but fail to find evidence for a relationship between any commodity price and conflict risk at the country level in their sample of Africa, South American and Asian states. Though, they do find evidence that rising commodity prices are associated with shorter and less intense conflicts for all commodity types.

Fjelde (2015) proposes that agricultural incomes, specifically, may be the key driver of the relationship between economic development and civil conflict in countries most at risk of conflict. Using agricultural price shocks and civil war events in Africa, Fjelde outlines a clear relationship between agriculture and conflict: as incomes from farming rise, conflict becomes less likely. Fjelde's cross-national approach allows for greater confidence in the external validity of the proposition, but it cannot establish a link between specific actors and thus examine mechanisms. This paper will move beyond Fjelde's article by using a case study that allows for the examination of individual conflict actors and mechanisms.

Dube and Vargas (2013) use coffee and oil price shocks to examine the differential impact of price volatility in these commodities on conflict in Colombia. They find a negative relationship between coffee prices and aggregate conflict events, while finding a positive relationship between oil prices and conflict events. The authors are able to show that coffee prices also affect local wages and hours worked as a possible mechanism through which the primary relationship may transmit. However, they did not continue to check the second stage of the mechanism – from wages and hours worked to conflict, nor were they able to test competing mechanisms with the data they had. In a re-examination of this case study, this paper moves beyond Dube and Vargas by disaggregating the country-level conflict events to the group-level (involving individual guerrilla groups) – showing that the relationship does not hold for all groups, only the most powerful in the conflict region. It also finishes the test of the opportunity cost mechanism and pits it against others previously untested.

Agriculture and Conflict

Rebellions often occur in the peripheries, where economies are more likely to be dominated by agricultural production (Desai and Eckstein 1990, Mason 2004, Kalyvas 2007). Popkin (1979) directly links opportunity cost in agricultural communities to conflict, outlining how the rational peasant will review their personal cost and gain from rebel activity and compare this to their peaceful farming lives when considering participation in a conflict group. As a reduction in agricultural incomes represents a drop in opportunity costs, rational farmers should be increasingly likely to turn to soldiering for a group that offers better returns. Collier and Hoeffler (1998) elaborate on the opportunity cost of conflict to include both concern over lost income and damage to institutions and infrastructure that may reduce future prosperity. Miguel

et al. (2004) directly relate agricultural income to conflict using variation in rainfall to model opportunity costs of conflict in Africa, finding significant results to support their hypotheses.

In a consideration of opportunity costs, we should expect groups that offer the best selective incentives to be the primary recipient of any new labour supply. Beyond pecuniary recompense, insurgent organisations can offer a multitude of incentives as simple as a warm meal. They can also offer protection in an unstable environment, and even promise future benefits to be paid out when they are finally victorious. Faced with a cost-benefit analysis, impoverished farmers, who feel they have no better employment opportunities, are likely to choose to join a rebel group which they see as being the most likely to improve their position. That is, the most likely to provide desired resources, the least likely to cost them their life, and the most likely to secure future benefits (the most likely to win). We already know that rebel groups attract recruits by signalling credibility (Kalyvas 2006, pp. 126–27), and credibility is much easier to achieve when the group appears strong, which is why conflict actors regularly tout their successes and cover up their losses. Rational recruits would much prefer to join a side they believe is going to win, and certainly not one they believe has a good probability of losing (Lichbach 1998, pp. 67–68). These considerations are best fulfilled by the most powerful rebel group, the best indicators of which, are technology, manpower, and territorial control.

The Al Nusra front active in the Syrian civil war can be considered a case in point. Established at the beginning of 2012 the group grew rapidly, quickly gaining notoriety – being described as the 'most aggressive and successful group' in the Free Syrian Army (Ignatius 2012). This reputation for strength made Al Nusra the group everyone wanted to join, with fighters describing it as 'the "best" group in terms of taking care of fighters and benefits' (Mironova 2016, 2019, p. 83).

Of course, in circumstances where rebel groups operate in entirely distinct geographic regions, their monopsony position will most likely consume all the new rebel labour supply, irrespective of whether there is a stronger group on the other side of the country. There may also be some rare cases where a very small rebel group has control of lucrative natural resources or is funded by an external state. Under these circumstances, the small group may be able to offer excessive wages to attract recruits. Nevertheless, these circumstances are considered likely to be few and far between.

Still, any group could renege on its promises – no matter the size. If a new incumbent believes that they can avoid paying their soldiers once victory is achieved and they are secure enough not to be challenged by their former comrades rebelling again, the incumbent may very well take that option. However, this is less likely with a large group because the larger the force that the incumbent would upset, the less secure in their position would be from another takeover attempt.

In sum, a fall in the opportunity cost of soldiering causes increasing numbers to opt into that profession because employment in rebellion now offers better benefits than productive occupations. These recruits swell the ranks of the most powerful rebel group, eschewing weaker groups that are less able to provide benefits and protection. As the size of an army grows, its ability to engage in warfare also increases – 100 soldiers can do more damage than 10, and 10,000 can do more than 100. The increasing supply of soldiers thus raises the ability of the most powerful group to engage in armed conflict, making violence by that group more likely.

Equally, a rise in the opportunity cost of soldiering will attract recruits away from the more powerful group at a faster rate than for a less powerful group. This is because recruits engaging in cost-benefit analysis are more likely to have joined the more powerful rebel group in the first place. With a larger percentage of these soldiers among their ranks, the more powerful group is likely to feel the greatest impact of an increase in agricultural incomes.

H1: A reduction in agricultural income is associated with an increase in the likelihood of violent conflict only for the strongest rebel group in a conflict zone.

Research Design

Case Selection

This paper will test the hypotheses using disaggregated data from a single case study – the Colombian internal conflict. This case is selected because it is a 'typical' case in which to find evidence of the proposed relationships and mechanisms (Seawright and Gerring 2008). A direct relationship between agricultural income and the likelihood of violence has been found here before, for example (Dube and Vargas 2013). Furthermore, several armed groups have been involved in this conflict over a long period and across a wide geographical area meaning that they are likely to compete for recruits. The state provides a wide array of public goods across the country, while Colombia is marked by stark inequality of income – being one of the most unequal countries in the world (Serrano 2018). Globally, Colombia is counted as an upper middle-income country (World Bank 2023) with a long history of stable democracy, and oil and other commodity exports have generated large revenues on which the Colombian state has built comparatively effective public services.

Case Study

Colombia has struggled with societal unrest for over a century (Acemoglu *et al*. 2015). The current ongoing conflict in Colombia can be traced back to the 1960s when three insurgent organisations were founded. These were the Revolutionary Armed Forces of Colombia (FARC), the National Liberation Army (ELN), and the Popular Liberation Army (EPL), all of which were left-leaning movements. These groups were joined by *M*-19, another leftist group, in 1970. However, *M*-19 disbanded in 1990 and the EPL has been a relatively insignificant player since it widely demobilised in 1991. This leaves the primary insurgent organisations – the FARC and the ELN – for which conflict data has been consistently collated since 1989.

The FARC was established in 1966 with the backing of the Colombian Communist Party. Following a Marxist-Leninist ideology, the group primarily comprised rural peasants seeking to bring about a more equitable distribution of wealth through state transformation (Ferro and Uribe 2002, as cited in Arjona and Kalyvas 2008). By the early 1980s, the FARC was divided into approximately 60 war fronts and counted between 12–15,000 fighters within its ranks (Otero 2007, as cited in Ugarriza and Craig 2013). In close comparison, the ELN was founded in 1963. While it followed a similar ideological position – Marxist-Leninism – it was established by a more middle-class group of student leaders and union officials (Chernik 1999, as cited in de Posada 2009). Nevertheless, as with the FARC, the ELN relied heavily on peasant communities to recruit its soldiers (Arjona and Kalyvas 2011, p. 152) and funded itself with narco-trafficking and kidnapping. In contrast to the FARC, the ELN has been consistently smaller in size, but grew to almost half its size by the early 1980s (Sanín 2012, p. 182). Thus, the two groups can be counted as very similar in terms of aims, ideology, recruitment base and funding, yet differing in size. On 24 November 2016, the FARC signed a peace agreement with the Colombian government. At the time of writing, the ELN is currently still in open conflict with state forces.

Dependent Variable

The dependent variable of interest in this study is conflict incidence. This paper will use binary indicators of conflict incidence by municipality and rebel group, employing two separate sources to confirm validity of the indicator and findings. It will also move beyond the binary incidence indicator of previous works to look at variation in the number of conflict events as well. The two sources of conflict data that will be used are the (UCDP) Georeferenced Event Dataset (Sundberg and Melander 2013), and the Panel Conflicto y Violencia of the Panel Municipal del CEDE. The UCDP Georeferenced Event Dataset (version 19.1) can be mapped across the

municipalities of Colombia and includes the years 1989–2018. According to this dataset, a conflict event is 'an incident where armed force was used by an organised actor against another organized actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date' (Högbladh 2019). The UCDP coding allows for attacks against civilians to be filtered out. However, in instances of conflict between violent actors, it does not discriminate between guerrilla-initiated attacks and those initiated by the state. Therefore, the UCDP indicators will be verified with the use of data from an alternative source based in Colombia.

The Panel Conflicto y Violencia of the Panel Municipal del CEDE is a dataset compiled by El Centro de Estudios sobre Desarrollo Económico (CEDE) based at the Universidad de los Andes in Bogotá from various sources (CEDE 2017). This paper will use disaggregated data on the number of guerrilla attacks by FARC and the ELN on military targets in their original form (count) and converted to a yearly incidence variable. The primary source of data for these variables is collated from state departments such as the Administrative Department of Security. Because each of these sources is likely to have their own particular reporting bias, this paper will thus examine data from both for validation purposes – including binary and count indicators.

To conclude, the dependent variable is either a dummy or count indicator of FARC or ELN conflict events by municipality-year (the unit of analysis). These indicators are verified by two sources giving a total of eight dependent variables (two groups, two sources, and two specifications of the dependent variable). Note that these indicators exclude violence against civilians and so removes any concern that models are detecting rapacity as the cause behind an increase in rebel attacks (Koren and Bagozzi 2017, Crost and Felter 2020). The below map (Figure 1) shows the position of conflict events coded by UCDP from 1989 to 2018. The image reveals the widespread nature of conflict with the FARC and ELN, which has affected most of the country.

As with many studies of recruitment, this paper examines conflict indicators rather than recruitment directly (Regan and Norton 2005, Berman *et al*. 2011, Vadlamannati 2011, Dube and Vargas 2013). Rebel groups have obvious incentives to hide their true power from the enemy and thus do not make recruitment information public. Although some estimates exist for the size of the FARC and ELN at various points during the conflict, these are not regarded as highly accurate and are numbered in thousands only as estimates of country-wide guerrilla size. Hopefully, recruitment can be more accurately measured in the future, at which point using a direct measure would be vastly preferable.

Independent Variables

Agricultural income is captured in this paper using coffee production income. Coffee is grown widely in Colombia; it is the main agricultural export

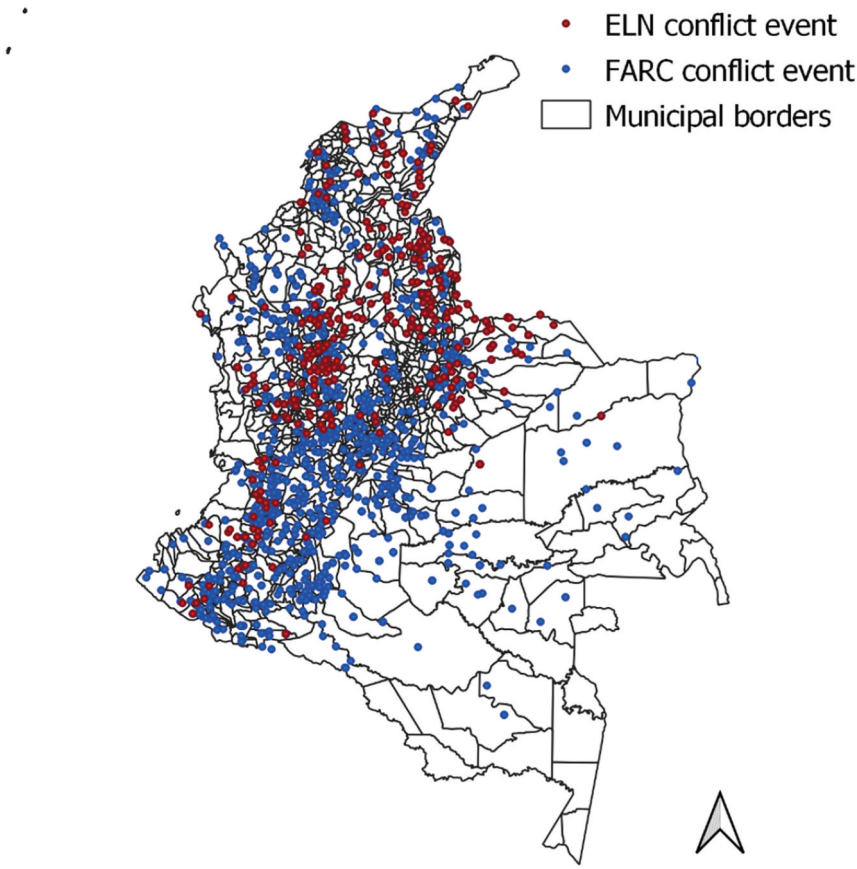

Figure 1. UCDP conflict events in Colombia disaggregated by rebel group, 1989–2018.

and second largest commodity exported by value behind mineral fuels (oil, coal, etc.). The vast majority of coffee is grown on family-run smallholdings in over 500 municipalities of Colombia but attracts a regular seasonal agricultural workforce for harvesting (Ortiz 1999). In 2010, coffee exports were valued at US$2.3 billion and represented 16 per cent of official national agricultural GDP (Andrade *et al*. 2013).

By measuring coffee income via production and international prices, this paper side-steps the issue of the informal nature of some production in Colombia, in which personal incomes may not be registered. The price for coffee beans is set internally in Colombia, which may be biased by factors relating to the internal conflict. Because of this, coffee income is instrumented in this study by an interaction of international prices and local weather and soil conditions. These instruments build on those used in Dube and Vargas (2013) with the addition of soil condition data from the Harmonized World

Soil Database v1.2, which improves the identification of the endogenous variable. Although Bove and Gavrilova (2014) find that conflict events in Afghanistan did not affect commodity prices in the long-run, this paper further proxies international coffee prices using the production levels of the top three coffee producing nations (excluding Colombia) to ensure that variation in Colombian production is not feeding back into price. International production data was obtained from the International Coffee Organization.

Data on coffee production by municipality is from a census of coffee production conducted by the Colombian National Coffee Federation in 1997. Intensity is measured by the number of hectares planted and was coded from official reports by Guhl (2004). Figure 2 below shows the intensity of coffee production across Colombia in 1997.

Thus, the key independent variable is measured using an interaction of coffee production intensity (hectares planted) and log internal prices. While this is the most direct measure of agricultural income from coffee,

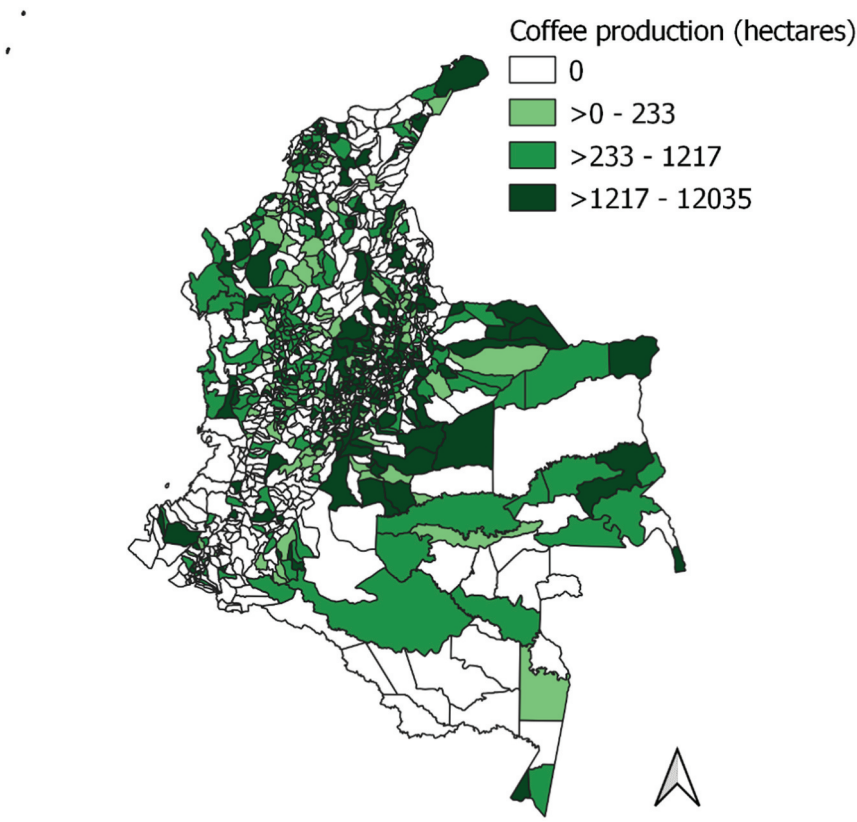

Figure 2. Coffee intensity by municipality (hectares planted), 1997.

the internal price is based on internal supply factors as well as world prices. Because internal supply can be affected by conflict (delayed harvests, destroyed crops, population decline, and displacement), this variable is instrumented using interactions of local soil conditions (for production intensity) and the international price of coffee, which is itself proxied using international production figures (excluding Colombia) so as to remove any potential influence of conflict on the independent variable.

Coffee is grown on shrubs/small trees, which means that production requires long-term investment. The substitution to other forms of agricultural production when coffee prices are low, is costly. Therefore, producers are likely to sit out bad times, hire fewer seasonal workers and take a personal financial hit. This hit to both producers and seasonal workers may then translate into conflict as described above. Note here that coffee is not a common foodstuff used in the relief of hunger. Thus, examination of this commodity can distinguish the consequences of a shift in income on conflict outcomes from a shift in food security and hunger (Martin-Shields and Stojetz 2019). Examination of the opportunity cost mechanism will use the same data as Dube and Vargas (2013) – from the Encuesta Nacional de Hogares (ENH). This household survey has a rural component conducted in 23 out of 32 departments, which captures incomes and hours worked in the agricultural sector.

In a comparison with potential grievance factors as mechanisms transferring the impact of shifting agricultural income to conflict, indicators of public goods provision and vertical inequality will be examined. The level of local tax income and public goods provision will be measured by four separate variables. The first measures the level of local government spending per capita on public goods and services, including schooling and healthcare. The second and third, measure central government transfers to the local municipality for direct spending on health or education. An observed reduction in spending on public services should indicate the potential for grievances resulting from under-provision. The final variable measures municipal tax revenues, indicating potential spending power. Again, a reduction in potential spending should correlate with a reduction in actual spending that results in grievances against the state. None of these variables are expected to correlate with security spending by municipality, as this is managed by the central state following military strategy and necessity.[3]

Municipal governments in Colombia are able to borrow to increase spending beyond revenues. Some local governments were seemingly liberal in their attitude to debt during the 1990s; however, since regulations were brought in in 1997, 2000 and 2003 local government debt levels have moderated and stood at 3.9 per cent of overall public debt in 2013 (UCLG and OECD 2016). All borrowing to pay for local services is included in the first measure of local

spending. Data for all variables is taken from the Panel Buen Gobierno of the Panel Municipal del CEDE.

The level of inequality is estimated using infant mortality multiplied by GDP. Infant mortality should fall as incomes rise because mothers and families are better able to afford adequate healthcare. Thus, inequality can be measured when incomes are rising but infant mortality is unchanged or increasing. As such, the variable used in this study reveals areas of large inequality where infant mortality and GDP are high. Areas with high infant mortality but low GDP, or low infant mortality and high GDP represent regions with more equal communities. This indicator is based on the well-established relationship between income inequality and infant mortality (Rodgers 1979, Flegg 1982, Nygård *et al.* 2017, Hillesund *et al*. 2018); however, to the knowledge of this author, it is the first time that this construction (interaction with GDP) has been used. Data on the rate of infant mortality is taken from Panel Salud y Servicios of the Panel Municipal del CEDE. GDP figures are not available for any period outside 2000–2009. Thus, GDP is proxied using the taxable base variable mentioned above. This indicator should closely follow total incomes within the municipality.

To consider the validity of this indicator, it is compared to intermittent census data collected in 1993 and 2005 in which a Gini coefficient was calculated for each municipality. As there is no data between these dates, this results in 2,086 observations with which to run a comparison. The correlation coefficient is 0.224. While this is a weak correlation, it is positive and statistically significant. The indicator used in this study can thus considered a weak proxy for vertical inequality and results should be interpreted as such.

Any informality in agricultural work in Colombia is not likely to affect the results of this study, given the indicators used. Coffee income is measured here by area sown and international prices, rather than declared incomes. If government spending is not affected by variation in coffee income because they are not reported, then it is equally unlikely that grievances will arise as spending falls because of a drop in coffee income – because they are not registered, they cannot have an impact on public finances. Finally, inequality, as measured by infant mortality, will still pick up variation in inequality, even if reported incomes remain unvaried. This is because a rise in infant mortality that results from changing unreported incomes, will still impact these measures.

Control Variables

Control variables include coca production, the municipal population, year, region and year*region fixed effects. Municipalities are the second-order political division of Colombia – departments being the first. There are also

four major geographic regions (non-political divisions) of Colombia, within which particular trends in violence or commodity production are likely to vary by natural conditions. These regions, therefore, enter the model as additional fixed-effect controls. Year*region fixed effects will also enter the model to control for time-varying factors at the regional level, such as political and economic policies.

Since the early 1980s, coca production has become a key element in the revenue generation of both guerrilla and paramilitary groups in Colombia. This lucrative agricultural product has been noted as a motivator for rebel expansion (Cook 2011, p. 22). Converting land use from legitimate agricultural production to coca cultivation and vice-versa may influence the relationship between coffee income and conflict. Therefore, it must enter the model as it is a potential confounder. Data on the coca cultivation is obtained from two sources. The Dirección Nacional de Estupefacientes (DNE) has an indicator of coca production in 1994 which is supplemented with data from 2001 onwards by data from the Panel Conflicto y Violencia of the Panel Municipal del CEDE. The variable is a dummy with values of 1 if coca is being cultivated and 0 otherwise.

The log of municipal population will enter the model to account for the scale effect as the dependent variables of guerrilla attacks and events are likely to become larger as the population increases. Larger populations also allow for greater income and so, population should enter the model as a control. Population data from the Panel Caracteristicas Generales of the Panel Municipal del CEDE for 1993–2014. This data is extended with data from Dube and Vargas (2013) to take coverage back to 1989 where necessary.

Method

Linear instrumental variable regression with fixed effects is used to examine the direct relationship between coffee income and conflict. The primary model specification has two stages. The second stage estimates the effect of commodity prices on conflict and can be represented by

$$y_{jrt} = \alpha_j + \beta_t + \delta_r t + \left(Cof_{jr} \hat{\times} CP_t\right)\rho + X_{jrt}\varphi + \varepsilon_{jrt}, \quad (1)$$

where y_{jrt} are conflict incidence variables including the dummy and count variables from both UCDP and CEDE in municipality j, region r, and year t; α_j are municipality fixed effects; β_t are year fixed effects; and X_{jrt} are time-varying controls which includes coca production and the natural log of population; Cof_{jr} is the municipality-level measure of coffee production; and CP_{t} is the natural log of the internal coffee price in year t adjusted for inflation. In Equation (1), ρ measures the effect of coffee price on conflict incidence in

municipalities where coffee is produced (primary independent variable). δ_{rt} are region fixed effects.

In the regression, the first stage which estimates for coffee income can be represented by

$$\text{Cof}_{jr} \times \text{CP}_t = \alpha_j + \beta_t + \delta_{rt} + \sum_{m=01}^{1} \sum_{n=0}^{1} \left(R_{jr}^{m} \times T_{jr}^{n} \times \text{FE}_t \right) \theta_{mn} + \text{X}_{jrt}\rho + \mu_{jrt}, \quad (2)$$

where R_{jr}^{m} is the water availability index of municipality j in municipality r raised to the power m, T_{jr}^{n} is the average annual temperature of municipality j raised to the power n;$\theta_{00} = 0$; FE_t is the (log) coffee export volume of the world's top three coffee exporters in year t; and X_{jrt} includes all exogenous explanatory variables in the second stage (1).

Linear instrumental variable regression is also used to model the relationship between coffee income and potential mechanisms variables. Testing of the second stage of the mechanism channel is completed using linear fixed effects models. It is not possible to continue to use instrumental variable regression for the relationship between the mechanism variable and conflict because the exclusion restriction is violated by our expectation that there may be multiple channels through which the instruments may now affect the dependent variable (conflict).[4]

Linear models are preferred as non-linear fixed-effects models drop observations of units that do not vary on the dependent variable. As this may introduce bias into the results, linear instrumental variable regression is preferrable. Due to limited temporal coverage of some variables, the temporal coverage of the primary models varies (all periods are noted in the results tables). The unit of analysis is municipality-year. For table of descriptive statistics for model variables, see Table A0 of the supplementary material.

Results and Discussion

Table 1 presents the results of models using UCDP and CEDE data. First-stage diagnostics show that the instruments used for coffee income are effective. The Kleibergen – Paap F-statistic is above 10 in all models, confirming the strength of the instruments. The J-statistic p-value is also insignificant at standard levels, increasing confidence in the validity of the instruments.

From Table 1, it is clear that the relationship between agricultural income and conflict holds only for the activity of the FARC. While coefficients are negative for the ELN, they are not significant in any model. To substantively interpret the results, consider that the mean level of coffee production (intensity) for a coffee producing municipality is 1.55 (thousands of hectares). From a high to a low point of internal coffee prices (1997–2002), the value fell by 0.67 log points. This relates to a drop of 1.02 points in coffee income

Table 1. Agricultural income and conflict with the FARC and ELN in Colombia. See Table S1 of the supplementary material for table with full models, including controls.

	(1) FARC Conflict incidence (UCDP)	(2) FARC Conflict events (UCDP)	(3) ELN Conflict incidence (UCDP)	(4) ELN Conflict events (UCDP)	(5) FARC Conflict incidence (CEDE)	(6) FARC Conflict events (CEDE)	(7) ELN Conflict incidence (CEDE)	(8) ELN Conflict events (CEDE)
Coffee income	−0.07**	−0.18**	−0.02	−0.03	−0.13**	−1.03*	−0.06	−0.21
	(0.03)	(0.09)	(0.02)	(0.03)	(0.05)	(0.54)	(0.04)	(0.17)
Observations	16,252	16,252	16,252	16,252	12,422	12,422	12,422	12,422
Number of units	956	956	956	956	956	956	956	956
Temporal coverage	1989–2005	1989–2005	1989–2005	1989–2005	1993–2005	1993–2005	1993–2005	1993–2005
First-Stage Diagnostics								
KP F-Statistic	19.18	19.18	19.18	19.18	27.30	27.30	27.30	27.30
KP LM-Statistic (P)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Hansen J-Statistic (P)	0.86	0.78	0.55	0.87	0.78	0.78	0.18	0.30

Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Control variables, including population, coca cultivation, year and region fixed effects are omitted from table.

(intensity*log price) for the average municipality. Given this drop, Model 1 (FARC, UCDP) estimated an 8 per cent increase in the likelihood of conflict. It was a rise of 13 per cent by Model 5 (FARC, CEDE). Model 2 (FARC, UCDP) estimates an increase of 0.19 events per year, and Model 6 (FARC, CEDE) 1.08 attacks per year. Given that the average number of UCDP FARC events in the sample is 0.11 and CEDE is 0.64 attacks per year, these estimates are relatively large.

These findings directly support H1 – a reduction in agricultural income is associated with an increase in the likelihood of violent conflict only for the strongest rebel group in a conflict zone. In order to confirm that the mechanism of opportunity cost is driving these results as expected, this paper now turns to examine the mechanism explicitly.

Mechanisms

Table 2 repeats the results from Dube and Vargas (2013) of the first stage of the mechanism with relation to opportunity cost indicators – wages and hours worked. As can be seen, a rise in coffee price leads to a rise in both wages and hours worked in rural municipalities.

This study now uses these intervening variables of wages and hours worked to examine their relationship with FARC conflict events. Table 3 reports the results of these fixed effects regressions that include controls for population, coca, and tax base, as well as year and region fixed effects.[5] Again, we see that the level of hours worked and wages in a municipality is negatively and statistically significantly related to FARC conflict events.

Table 2. Replication of Dube and Vargas (2013) hours and wages models.

	(A) Log wage	(B) Log hours
Coffee income	0.371*	0.286**
	(0.217)	(0.125)
Observations	26,050	57,743
Temporal coverage	1998–2005	1998–2005

Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Controls omitted from table.

Table 3. Intervening variables and conflict.

	FARC Conflict incidence (UCDP)	FARC Conflict events (UCDP)	FARC Conflict incidence (CEDE)	FARC Conflict events (CEDE)
Log hours	0.05	−0.06	−0.24*	−1.48**
	(0.07)	(0.15)	(0.13)	(0.60)
Log wages	−0.08***	−0.17**	−0.11**	−0.27
	(0.03)	(0.09)	(0.05)	(0.23)

Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Controls omitted from table.

Thus, we have evidence that when coffee prices fall, rural incomes fall; and this fall in income is associated with a rise in conflict events. This clearly supports opportunity cost as the mechanism driving the primary relationship observed in Table 1, as expected. It also supports the proposition that some affected individuals are engaging in a cost-benefit analysis, in which they are most likely to decide to join the group that offers the best potential outcomes.

While there appears to be clear evidence for H1 and the mechanism of opportunity cost, it remains to be tested whether grievance factors are also playing a role. Finding evidence for such factors would cast doubt on the theoretical expectation that individuals engaged in cost-benefit analysis will always pick the strongest group. Such factors could be more likely to increase recruitment into specific groups that seek to represent the aggrieved community or promise to solve the injustice, for example. Thus, the paper now examines grievance factors potentially driving the relationship observed in Table 1 as a placebo test. These factors include grievances that result from inequality or a reduction in public good provision.

The provision of public goods has been considered one of the best ways to pacify a large population (Azam 1995, 2012, Fearon 1995). Several empirical studies have backed up this claim (Justino 2004, Berman *et al*. 2011, Beath *et al*. 2012). Where revenues from agricultural production constitute a source of state income through taxation, a reduction in agricultural incomes will result in diminished state revenues. Any resulting drop in redistributive payments and provision of public goods could lead to a reduction in support for the state as it loses hearts and minds (Azam 1995, Berman *et al*. 2011, Beath *et al*. 2012). It may also lead to grievances as previously held expectations of service are no longer met leading to frustration-aggression responses (Breuer and Elson 2017). Both these circumstances would lead to an increase in individuals opting into soldiering, seeking retribution, or desiring to aid a group that promises to redress their grievance (Collier and Hoeffler 2004).

Furthermore, reducing agricultural incomes may lead to grievances against the state through an increase in inequality. In modern political thought, the notion that vertical inequality will lead the aggrieved masses to volunteer in a revolution of the proletariat against the bourgeoisie can be traced back to Marx (2004). However, results from empirical testing of this theory have been mixed. Some authors find positive results, others negative, and yet more find no relationship at all (See Hillesund *et al*. 2018 for review). Hillesund *et al*. (2018, p. 5) attribute this to the poor quality of data we currently have on vertical inequality, the varying definitions of the concept, varying indicators chosen and varying research designs. Nonetheless, the contention remains noteworthy, as it is conceivable that a reduction in agricultural income will drive inequalities between individuals in agriculture and other sectors. The perception of such a gap, which the state is not

helping to relieve, may cause some rural workers to down tools and join the fight. Conflict becomes more likely as an increase in the size of the rebellion raises the group's ability to engage in conflict.

Table 4 presents the first stage placebo tests covering grievance factors. Coffee income is not significantly associated with tax revenues (Model 9). This suggests that government policy should not be adversely affected by falls in coffee income. Models 10–12 examine the relationship between coffee income and local government expenditure, as well as ringfenced transfers for education and healthcare from the central state. In contrast to Model 9, all of these models report statistically significant relationships between coffee income and spending variables – as coffee income falls in Colombia, expenditure on public services also drops.

Moving to inequality, the indicator derived from infant mortality is statistically significant in Model 13. However, the relationship is in the opposite direction from that expected – a rise in agricultural incomes causes a rise in inequality, and it does not appear that this relationship is simply being driven by a rise in GDP/taxable base (Model 16).[6] Perhaps this is because of government mitigation strategies and a focus on healthcare provision when incomes fall. Or, it could be because coffee growers are among the better paid agricultural workers – an experienced coffee picker can earn $30 per day (Rueda 2020), while the average wage for formal rural workers is closer to $8 per day (Bohorquez-Penuela and Otero-Cortes 2020). Thus, an increase in the income of coffee growers and pickers would lead to this group becoming relatively richer than those working with other produce.

Moving to the second stage of the mechanism – from intervening variable to outcome – Table 5 presents the coefficients of government spending, education transfers, health transfers, and inequality, when included individually in fixed-effects regressions of the key dependent variables relating to

Table 4. Agricultural income and placebo test variables. See Table S2 of the supplementary material for table with full models, including controls.

	(9) Tax base	(10) Government spending	(11) Education transfers	(12) Health transfers	(13) Inequality (infant mortality)
Coffee income	0.09	0.48**	0.78***	0.74***	69.23**
	(0.12)	(0.20)	(0.23)	(0.26)	(33.60)
Observations	15,104	15,104	10,118	10,118	15,085
Number of units	944	944	944	944	944
Temporal coverage	1988–2003	1988–2003	2000–2010	2000–2010	1998–2013
First-Stage Diagnostics					
KP F-Statistic	18.76	18.76	15.65	15.65	9.63
KP LM-Statistic (P)	0.05	0.05	0.04	0.04	0.00
Hansen J-Statistic (P)	0.44	0.16	0.15	0.12	0.76

Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Control variables, including population, coca cultivation, year and region fixed effects are omitted from table.

Table 5. Placebo test variables and conflict.

	FARC Conflict incidence (UCDP)	FARC Conflict events (UCDP)	FARC Conflict incidence (CEDE)	FARC Conflict events (CEDE)
Local government spending	−0.00	−0.01*	0.01**	−0.04*
	(0.00)	(0.00)	(0.00)	(0.02)
Education transfers	−0.00	0.01	−0.00	0.01
	(0.00)	(0.01)	(0.00)	(0.02)
Health transfers	0.00	0.01	−0.01*	−0.02
	(0.00)	(0.01)	(0.00)	(0.02)
Inequality (infant mortality)	−0.00	−0.00	−0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)

Control variables omitted from table. Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

FARC in Table 1. These regressions include the same controls as models involving wages and hours worked in Table 3.

As can be seen, none of the grievance variables is robustly correlated with conflict in this sample. Local government spending transfers come the closest to exhibiting the expected relationship – the correlation with FARC conflict events is in the right direction (negative) for both UCDP and CEDE data. However, the coefficient is positive and significant at the 5 per cent level for FARC conflict incidence in the CEDE data. Thus, results show almost no support for this step in the grievance mechanisms. It appears that grievances that arise from reduced government spending and increasing inequality, which are themselves the result of a fall in agricultural income, are not the mechanisms driving the relationship between agricultural incomes and conflict incidence. This could be explained by the informal nature of much of agricultural work around the globe – variation in incomes may be unlikely to impact government budgets.

In order to corroborate statistical findings, we can look at qualitative evidence in surveys and interviews of ex-combatants. Indeed, several researchers have noted reasons for joining guerrilla groups in Colombia that include material benefits (Florez-Morris 2007, p. 631, Ribetti 2007, p. 709, Arjona and Kalyvas 2011, p. 154). Ribetti (2007) notes in her analysis of rebel motivation in Colombia:

> Though the primary motivations are different, all informants mentioned that joining the guerrillas seemed to be the best option available to them, given their personal circumstances, their wants, and the lack (true or perceived) of viable legal alternatives. Indeed, they thought and were lured into believing that joining would provide for all they needed in exchange for seemingly easy tasks. Other, legal, choices that might have been available were perceived to involve harder work, and to be less profitable and predictable, or plainly boring (Ribetti 2007, p. 709).

Furthermore, Ribetti (2007, p. 709) notes that 'a sense of duty, and fighting for something bigger than oneself are rarely present in recruits as they join or

continue to participate in the [insurgent] organization', further suggesting that it is opportunity cost and not any grievance factor that is driving the relationship between agricultural income and conflict. Arjona and Kalyvas (2011, p. 155) find that those seeking to escape from poverty (an opportunity cost motivation) are almost twice as likely to have joined FARC than the ELN.

Still, there is some evidence that grievances against the state have played a role in the Colombian conflict. In a survey of ex-combatants in 2003, Florez-Morris (2007, p. 620) noted the most oft-cited reason for joining a guerrilla group was the 'concern regarding socioeconomic injustice and inequality, and the desire to improve these situations'. However, this survey of recruitment into the *M*-19 included a sample of only 42 individuals, most of which were middle-class, urban dwellers. It is possible that Florez-Morris is thus capturing an urban-intellectual sample with quite different motivations (Tezcür 2016), rather than the rural sample in which we are interested. Indeed, similar reports were not found in other surveys (Ribetti 2007, Arjona and Kalyvas 2011), supporting opportunity cost as the primary motivator of rural recruits experiencing an income shock.

Such a finding helps to explain the results presented in Table 1. It would seem that FARC is the only group to benefit from the new supply of labour caused by a downward shift in farming income because it is the most powerful insurgent group and thus the most likely to provide desired resources, the least likely to cost recruits their life, and the most likely to secure future benefits. Thus, the relationship between farming and fighting is likely to hold generally across countries and regions, but within a region it will hold only for the strongest group.

The relationship between returns from agricultural employment and the incentive to join an insurgency may, at first sight, appear similar to the argument of Scott (1976): one could argue that subsistence crises are causing increases in rebel recruitment. However, there is no evidence to support this mechanism in surveys of ex-combatants, i.e., to the knowledge of this author, no-one has reported the threat of starvation as their motivation to join the insurgency (Ribetti 2007, Florez-Morris 2007, Arjona and Kalyvas 2011). It is, therefore, believed that evidence presented here supports the theory of opportunity cost, not acute subsistence crises.

Checks of Robustness and Limitations[7]

Checks of robustness include the addition of a measure of paramilitary activity, logged indicators of count-form dependent variables, an extension of the time period studied, lagged intermediary variables in stage-two regressions, restriction of the analysis to municipality years in which both rebel groups were active, and spatial lag models. Results presented in the appendix

showed little substantive change that would alter the interpretation of results presented above.

Two further potential concerns remain. These relate to the accurate measurement of the influence of coca cultivation and the campaign tactics of the two groups. This study uses a dummy variable to control for the influence of coca on the relationship between coffee income and conflict in all models. Recent work has suggested coca income can be exogenously estimated using the US street price and local soil conditions in Colombia (Nussio and Ugarriza 2021). To confirm that the specification of the coca control variable is not causing spurious results, an exogenous measure was used. Results presented in Table A12 of the appendix show almost no change from results presented in Table 1.

With regard to campaign tactics, it is possible that the ELN, as a smaller group, relies more heavily on guerrilla tactics and so uses attacks on infrastructure and acts of terrorism more often than direct confrontation with the Colombian national army. In order to ensure that any relationship between agricultural income and conflict is not being missed because of the choice of conflict indicator, Table A13 of the appendix reports results of models with two new dependent variables – attacks on private property and terrorist attacks. These models continue to support H1, finding no evidence that ELN conflict activities are associated with coffee income.

A clear limitation of this study is that it could not assess conflict onset. Unfortunately, it was not possible to examine whether the relationship between farming and fighting holds for onset as data do not extend back to before the start of the conflict. Future research should consider an examination of onset, perhaps through multiple onsets within a single country (with repeated or multiple rebel groups).

This study focuses on two groups that do not use ethnicity as a means of recruitment. Previous studies do not suggest that the relationship between agricultural income and conflict works through ties of ethnicity (Dube and Vargas 2013, Fjelde 2015). However, future works could repeat this examination in a setting in which groups recruit using both selective incentives and ties of ethnicity to confirm that co-ethnics adversely affected by agricultural income shocks would not choose the representative group over a stronger group recruiting via selective incentives.

One mechanism, not considered here, that could transmit the effect of a change in agricultural income on conflict outcomes is horizontal inequality. Buhaug *et al*. (2020) suggest that income losses trigger violent mobilisation in ethnic conflict where the shock can be linked to pre-existing grievances. Nevertheless, this contention is not examined in the current study as the Colombian conflict is not characterised by ethnic animosity, and so, horizontal inequalities can be discounted as mediating any relationship between agricultural incomes and conflict within the municipalities of this country.

This limitation could be overcome by examining more case studies in future research.

A gender lens could be applied to ask whether a differential impact of shifting agricultural incomes might have bolstered recruitment into one guerrilla group over the other. According to Alpert (2016), 'women made up about 40 per cent of the FARC and about 25 per cent of the ELN'. When we compare this with information from the Colombian Coffee Growers Federation (2023), which states that approximately 31 per cent of coffee growers in Colombia are women, we can see that the estimates of females occupied in each profession are relatively similar. There is also no immediate reason to suspect that women were more intensely affected by changing coffee prices than men, which would result in them swelling the ranks of FARC rather than the ELN. However, future works should delve more deeply into this aspect to fully uncover any gendered response to shifting agricultural incomes that may more intensely impact one rebel group over another.

Finally, it is possible that FARC's electoral ambitions, which were not shared by the ELN, could have signalled greater credibility and thus attracted more recruits. Still, it could also have signalled the possibility that rank-and-file soldiers might be sold out if the leadership were given an opportunity to safely and effectively pursue election. Arjona and Kalyvas (2011) asked 821 ex-combatants from both FARC and the ELN to self-report their motivations for joining. According to their coding, the electoral ambitions of FARC did not play a role. Furthermore, the related motivation of ideology was reported much more often among recruits of the ELN than FARC. Nevertheless, further research is required to fully explore the influence of electoral ambitions on credibility and attractiveness to rebel recruits.

Conclusion

This paper set out to answer the questions – which rebel groups are most likely to be affected by a fall in agricultural income, and why? It proposed that the relationship only holds for the strongest rebel group in a conflict zone as would-be recruits, engaged in cost-benefit analysis, choose the group that promises the greatest benefits at the lowest cost. Using granular data from the case of Colombia over the period 1989–2005, this study found support for the proposition and for opportunity cost as the driver of this relationship. These findings suggests that the opportunity cost of rebellion is agricultural employment (Hirshleifer 1988, Collier and Hoeffler 1998). However, there is still much that data analyses at the group level cannot tell us. Future research should engage with the individual level to further understand the link between agricultural incomes and conflict. In addition, further work is required to see if these results differ in other settings, perhaps in the presence of groups that recruit through social ties

of ethnicity, as well as consider the mechanism of horizontal inequalities where possible.

Finally, it should be noted that the findings presented here do not preclude other individual motivations to engage in conflict (Wood 2003, Sanín 2004, Ribetti 2007, Florez-Morris 2007, Ginges and Atran 2009, Arjona and Kalyvas 2011, Sanín and Wood 2014, Gómez *et al*. 2017). Nor do they imply that raising opportunity costs alone is the only way to avoid conflict. Indeed, survey work has noted an array of motivations for individual involvement (Sanín 2004, Ribetti 2007, Florez-Morris 2007, de Posada 2009, Arjona and Kalyvas 2011). Nevertheless, improving the lives of those working in the agricultural sector should be seen as one of a set of key policy instruments with which to reduce the risk of conflict around the globe. More can and should be done to increase mobility and education in rural areas specifically, which will allow members of the agricultural workforce to exit this industry when times get tough, rather than turn to non-productive occupations. Indeed, given the findings presented here, it appears that offsetting agricultural incomes with public goods or changes in inequality with transfers is not likely to maintain peaceful societies.

Notes

1. Data on plausibly exogenous cross-section variations in local weather and soil conditions available at the sub-national level is interacted with exogenous variation at the international level (world coffee prices) to instrument for local coffee production income.
2. Collier and Hoeffler build their model on the contest model literature See Hirshleifer (1988, 1991), Grossman (1991, 1995), Skaperdas (1992), and Azam (1995).
3. The central state even controls the number of police officers and judges in each municipality (Acemoglu *et al*. 2015, p. 2367).
4. Mediation effects models including instrumental variable regression do not exist to the knowledge of this author.
5. These models contain departmental rather than municipal fixed effects as the average number of time points per municipal unit is only 3.
6. Nor does it appear to be driven by infant mortality alone – see results in the appendix.
7. For results of the models discussed in this section see Tables A1–A14 of the appendix.

Acknowledgements

I would like to thank Professors Kristian Skrede Gleditsch and Han Dorussen for their support and advice through my PhD, of which this research formed a part. I would also like to thank colleagues at the University of Essex and University of Warwick for

feedback on working drafts of this paper. Finally, I would like to express my gratitude to the anonymous reviewers and editor for helping me to improve the manuscript prior to publication.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Economic and Social Science Research Council under Grant [ES/J500045/1].

Notes on contributor

Phillip Nelson is an Honorary Research Fellow at the University of Warwick. He was awarded his PhD from the University of Essex in 2019 using advanced quantitative methods to examine why people fight in rebellion and how natural resources can be used by militias, not just rebel groups, to fund their operations. His previous research has been both cross-national and sub-national, with a focus on Colombia. During his PhD, Phillip spent three months as a Visiting Research Fellow at the Universidad del Rosario in Bogotá. Phillip has received funding for his research from the Economic and Social Research Council as well as the Research Development Fund at Warwick university. He is a member of the Conflict Research Society, and the Interdisciplinary Peace and Conflict Research Network. Phillip's research interests include housing, civil conflict, public support for war, armed actor recruitment and militia strategy.

ORCID

Phillip Nelson http://orcid.org/0000-0002-5711-4987

References

Acemoglu, D., García-Jimeno, C., and Robinson, J.A., 2015. State capacity and economic development: a network approach. *American Economic Review*, 105 (8), 2364–2409. doi:10.1257/aer.20140044.

Alpert, M., 2016. To be a guerrilla, and a woman, in Colombia. *The Atlantic*. Available from: https://www.theatlantic.com/international/archive/2016/09/farc-deal-female-fighters/501644/ .

Andrade, R., *et al*., 2013. Coffee in Colombia: waking up to an opportunity. *Knowledge at Wharton*, 1–4.

Arjona, A.M. and Kalyvas, S.N., 2008. Rebelling against rebellion comparing insurgent and counter-insurgent recruitment. *Unpublished paper prepared for mobilisation for political violence: what do we know*.

Arjona, A.M. and Kalyvas, S.N., 2011. Recruitment into armed groups in Colombia: a survey of demobilized fighters. *In*: Y. Guichaoua, ed. *Understanding collective political violence*. London: Palgrave Macmillan UK, 143–171. doi:10.1057/9780230348318_8.

Azam, J.-P., 1995. How to pay for the peace? A theoretical framework with references to African Countries. *Public Choice*, 83 (1–2), 173–184. doi:10.1007/BF01047691.

Azam, J.-P., 2001. The redistributive state and conflicts in Africa. *Journal of Peace Research*, 38 (4), 429–444. doi:10.1177/0022343301038004002.

Azam, J.-P., 2012. Conflict and development. *In*: E. Aryeetey, S. Devarajan, R. Kanbur, and L. Kasekende, eds. *The Oxford companion to the economics of Africa*. Oxford: Oxford University Press, 110–114.

Bazzi, S. and Blattman, C., 2014. Economic shocks and conflict: evidence from commodity prices. *American Economic Journal: Macroeconomics*, 6 (4), 1–38. doi:10.1257/mac.6.4.1.

Beath, A., Christia, F., and Enikolopov, R., 2012. Winning hearts and minds through development? Evidence from a field experiment in Afghanistan. *Policy Research Working Papers*. *World Bank*.

Berman, E., *et al*., 2011. Do working men rebel? Insurgency and unemployment in Afghanistan, Iraq, and the Philippines. *Journal of Conflict Resolution*, 55 (4), 496–528. doi:10.1177/0022002710393920.

Berman, E., Shapiro, J.N., and Felter, J.H., 2011. Can hearts and minds be bought? The economics of counterinsurgency in Iraq. *Journal of Political Economy*, 119 (4), 766–819. doi:10.1086/661983.

Besley, T.J. and Persson, T., 2008. *The incidence of civil war: theory and evidence*. Working Paper No. 14585. National Bureau of Economic Research.

Bohorquez-Penuela, C. and Otero-Cortes, A., 2020. *Blame it on the rain: the effects of weather shocks on formal rural employment in Colombia*. Bogotá, Colombia: Banco de la República Colombia, Centro de Estudios Económicos Regionales (CEER).

Bove, V. and Gavrilova, E., 2014. Income and livelihoods in the war in Afghanistan. *World Development*, 60 (August), 113–131. doi:10.1016/j.worlddev.2014.03.021.

Breuer, J. and Elson, M., 2017. Frustration-aggression theory. *In*: P. Sturmey, ed. *The Wiley Handbook of violence and aggression*. Chichester, UK: John Wiley & Sons Ltd, 1–12. doi:10.1002/9781119057574.whbva040.

Brückner, M. and Ciccone, A., 2010. International commodity prices, growth and the outbreak of civil war in Sub-Saharan Africa. *The Economic Journal*, 120 (544), 519–534. doi:10.1111/j.1468-0297.2010.02353.x.

Buhaug, H., *et al*., 2020. A conditional model of local income shock and civil conflict. *Journal of Politics*, 83 (1), 354–366. doi:10.1086/709671.

CEDE, 2017. Data from: panel conflicto y violencia [dataset]. Available from: https://datoscede.uniandes.edu.co/es/ [Accessed 28 Oct 2020].

Chatagnier, J.T. and Castelli, E., 2019. The arc of modernization: economic structure, materialism, and the onset of civil conflict. *Political Science Research and Methods*, 7 (2), 233–252. doi:10.1017/psrm.2016.24.

Chernik, M., 1999. La negociación de una paz entre múltiples formas de violencia [Peace negotiation under multiple violence forms. *In:* F. Leal, ed. *Los laberintos de la guerra*. Bogotá, Colombia: TM Editores, pp. 3–56.

Collier, P. and Hoeffler, A., 1998. On economic causes of civil war. *Oxford Economic Papers*, 50 (4), 563–573. doi:10.1093/oep/50.4.563.

Collier, P. and Hoeffler, A., 2004. Greed and grievance in civil war. *Oxford Economic Papers*, 56 (4), 563–595. doi:10.1093/oep/gpf064.

Colombian Coffee Growers Federation, 2023. FNC launches a line of coffee produced by women. Available from: https://federaciondecafeteros.org/wp/listado-noticias/fnc-launches-a-line-of-coffee-produced-by-women/?lang=en.

Cook, T., 2011. The financial arm of the FARC: a threat finance perspective. *Journal of Strategic Security*, 4 (1), 19–36. doi:10.5038/1944-0472.4.1.2.

Crost, B., *et al*., 2018. Climate change, agricultural production and civil conflict: evidence from the Philippines. *Journal of Environmental Economics and Management*, 88, 379–395. doi:10.1016/j.jeem.2018.01.005.

Crost, B. and Felter, J.H., 2020. Export crops and civil conflict. *Journal of the European Economic Association*, 18 (3), 1484–1520. doi:10.1093/jeea/jvz025.

Dal Bó, E. and Dal Bó, P., 2011. Workers, warriors, and criminals: social conflict in general equilibrium. *Journal of the European Economic Association*, 9 (4), 646–677. doi:10.1111/j.1542-4774.2011.01025.x.

de Posada, C.V., 2009. Motives for the enlistment and demobilization of illegal armed combatants in Colombia. *Peace and Conflict: Journal of Peace Psychology*, 15 (3), 263–280. doi:10.1080/10781910903032609.

Desai, R. and Eckstein, H., 1990. Insurgency: the transformation of peasant rebellion. *World Politics*, 42 (4), 441–465. doi:10.2307/2010510.

De Soysa, I. and Fjelde, H., 2010. Is the hidden hand an iron fist? Capitalism and civil peace, 1970-2005. *Journal of Peace Research*, 47 (3), 287–298. doi:10.1177/0022343310362167.

Dube, O. and Vargas, J.F., 2013. Commodity price shocks and civil conflict: evidence from Colombia. *The Review of Economic Studies*, 80 (4), 1384–1421. doi:10.1093/restud/rdt009.

Fearon, J.D., 1995. Ethnic war as a commitment problem. *In*: *Annual Meetings of the American Political Science Association*, New York, USA.

Fearon, J.D., 2003. Ethnic and cultural diversity by country. *Journal of Economic Growth*, 8 (2), 195–222. doi:10.1023/A:1024419522867.

Fearon, J.D. and Laitin, D.D., 2003. Ethnicity, insurgency, and civil war. *American Political Science Review*, 97 (1), 75–90. doi:10.1017/S0003055403000534.

Ferro, J.G. and Uribe, G., 2002. *El orden de la guerra. Las FARC-EP: Entre la Organización y la Política*. Bogotá: CEJA.

Fjelde, H., 2015. Farming or fighting? Agricultural price shocks and civil war in Africa. *World Development*, 67 (4), 525–534. doi:10.1016/j.worlddev.2014.10.032.

Flegg, A.T., 1982. Inequality of income, illiteracy and medical care as determinants of infant mortality in underdeveloped countries. *Population Studies*, 36 (3), 441–458. doi:10.1080/00324728.1982.10405597.

Florez-Morris, M., 2007. Joining guerrilla groups in Colombia: individual motivations and processes for entering a violent organization. *Studies in Conflict & Terrorism*, 30 (7), 615–634. doi:10.1080/10576100701385958.

Ginges, J. and Atran, S., 2009. What motivates participation in violent political action. *Annals of the New York Academy of Sciences*, 1167 (1), 115–123. doi:10.1111/j.1749-6632.2009.04543.x.

Gómez, Á., *et al*., 2017. The devoted actor's will to fight and the spiritual dimension of human conflict. *Nature Human Behaviour*, 1 (9), 673–679. doi:10.1038/s41562-017-0193-3.

Grossman, H.I., 1991. A general equilibrium model of insurrections. *American Economic Review*, 81 (4), 912–921.

Grossman, H.I., 1995. Insurrections. *In*: K. Hartley and T. Sandler, eds. *Handbook of defence economics* Vol. 1. Amsterdam: Elsevier Science B.V., 191–212. doi:10.1016/S1574-0013(05)80010-9.

Guardado, J. and Pennings, S., 2020. The seasonality of conflict. *World Bank Working Paper*. Available from: https://openknowledge.worldbank.org/handle/10986/34421.

Guhl, A.E., 2004. Café y Cambio de Paisaje En La Zona Cafetera Colombiana Entre 1970 y 1997. *Working Paper*. Available from: https://biblioteca.cenicafe.org/handle/10778/102.

Hegre, H. and Sambanis, N., 2006. Sensitivity analysis of empirical results on civil war onset. *Journal of Conflict Resolution*, 50 (4), 508–535. doi:10.1177/0022002706289303.

Hendrix, C.S. and Glaser, S.M., 2007. Trends and triggers: climate, climate change and civil conflict in Sub-Saharan Africa. *Political Geography*, 26 (6), 695–715. doi:10.1016/j.polgeo.2007.06.006.

Hillesund, S., *et al*., 2018. Horizontal inequality and armed conflict: a comprehensive literature review. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, 39 (4), 463–480. doi:10.1080/02255189.2018.1517641.

Hirshleifer, J., 1988. The analytics of continuing conflict. *Synthese*, 76 (2), 201–233. doi:10.1007/BF00869589.

Hirshleifer, J., 1991. The technology of conflict as an economic activity. *American Economic Review*, 81 (2), 130–134.

Högbladh, S., 2019. *UCDP GED codebook version 19.1*. Uppsala, Sweden: Department of Peace and Conflict Research, Uppsala University.

Ignatius, D., 2012. Al-Qaeda affiliate playing larger role in Syria rebellion. *The Washington Post*, 30 Nov.

Jakobsen, T.G., De Soysa, I., and Jakobsen, J., 2013. Why do poor countries suffer costly conflict? Unpacking per capita income and the onset of civil war. *Conflict Management and Peace Science*, 30 (2), 140–160. doi:10.1177/0738894212473923.

Jun, T., 2017. Temperature, maize yield, and civil conflicts in Sub-Saharan Africa. *Climatic Change*, 142 (1–2), 183–197. doi:10.1007/s10584-017-1941-0.

Justino, P., 2004. Redistribution, inequality and political conflict. 18. *PRUS Working Papers*.

Kalyvas, S.N., 2006. *The logic of violence in civil war*. Cambridge, NY: Cambridge University Press.

Kalyvas, S.N., 2007. Civil wars. *In*: C. Boix and S.C. Stokes, eds. *The Oxford handbook of comparative politics*. Oxford: Oxford University Press, 1–25.

Koren, O. and Bagozzi, B.E., 2017. Living off the land: the connection between cropland, food security, and violence against civilians. *Journal of Peace Research*, 54 (3), 351–364. doi:10.1177/0022343316684543.

Koubi, V., 2018. Exploring the relationship between climate change and violent conflict. *Chinese Journal of Population Resources and Environment*, 16 (3), 197–202. doi:10.1080/10042857.2018.1460957.

Lichbach, M.I., 1998. *The Rebel's dilemma*. Ann Arbor: University of Michigan Press.

Martin-Shields, C.P. and Stojetz, W., 2019. Food security and conflict: empirical challenges and future opportunities for research and policy making on food security and conflict. *World Development*, 119, 150–164. doi:10.1016/j.worlddev.2018.07.011.

Marx, K., 2004. *Capital: a critique of political economy*. London: Penguin UK.

Mason, D.T., 2004. *Caught in the crossfire: revolution, repression, and the rational peasant*. Lanham, Maryland: Rowman and Littlefield Publishers Inc.

McGuirk, E. and Burke, M., 2016. Economic shocks and varieties of conflict: global prices, real income and local violence in Africa. *Real Income and Local Violence in Africa*, (Oct 21, 2016). doi:10.2139/ssrn.2776263.

McGuirk, E. and Burke, M., 2017. The economic origins of conflict in Africa. *Journal of Political Economy*, 128 (10), 3940–3997. doi:10.1086/709993.

Miguel, E., Satyanath, S., and Sergenti, E., 2004. Economic shocks and civil conflict: an instrumental variables approach. *Journal of Political Economy*, 112 (4), 725–753. doi:10.1086/421174.

Mironova, V.G., 2016. Rebel recruitment. *Harvard Kennedy School Belfer Center Newsletter*.

Mironova, V.G., 2019. *From freedom fighters to jihadists: human resources of non-state armed groups*. Oxford: Oxford University Press.

Mousseau, M., 2012. Capitalist development and civil war. *International Studies Quarterly*, 56 (3), 470–483. doi:10.1111/j.1468-2478.2012.00734.x.

Nelson, P., 2021. The indivisible hand of peace? Consumption opportunities and civil war. *Defence and Peace Economics*, 32 (5), 533–549. doi:10.1080/10242694.2019.1703441.

Nussio, E. and Ugarriza, J.E., 2021. Why rebels stop fighting: organizational decline and desertion in colombia's insurgency. *International Security*, 45 (4), 167–203. doi:10.1162/isec_a_00406.

Nygård, H.M., *et al.*, 2017. Inequality and Armed Conflict: Evidence and Data. Background paper for the United Nations–World Bank Flagship Study, Pathways for Peace: Inclusive Approaches to Preventing Violent Conflict.

Ortiz, S., 1999. *Harvesting coffee, bargaining wages: Rural labor markets in Colombia, 1975-1990*. University of Michigan Press.

Otero, D.F., 2007. *Las cifras del conflicto colombiano*. Bogota: Indepaz.

Popkin, S.L., 1979. *The rational peasant: the political economy of rural society in Vietnam*. Berkeley: University of California Press.

Raleigh, C. and Kniveton, D., 2012. Come rain or shine: an analysis of conflict and climate variability in East Africa. *Journal of Peace Research*, 49 (1), 51–64. doi:10.1177/0022343311427754.

Regan, P.M. and Norton, D., 2005. Greed, grievance and mobilization in civil wars. *Journal of Conflict Resolution*, 49 (3), 319–336. doi:10.1177/0022002704273441.

Ribetti, M., 2007. The unveiled motivations of violence in intra-state conflicts: the Colombian guerrillas. *Small Wars & Insurgencies*, 18 (4), 699–720. doi:10.1080/09592310701778548.

Rodgers, G.B., 1979. Income and inequality as determinants of mortality: an international cross-section analysis. *Population Studies*, 33 (2), 343–351. doi:10.1080/00324728.1979.10410449.

Rueda, M., 2020. No pickers, no coffee: how covid threatens colombia's harvest. *BBC News*, 13 Dec 2020. Available from: https://www.bbc.co.uk/news/world-latin-america-55172034.

Sanín, F.G., 2004. Criminal rebels? A discussion of civil war and criminality from the Colombian experience. *Politics & Society*, 32 (2), 257–285. doi:10.1177/0032329204263074.

Sanín, F.G., 2012. The dilemmas of recruitment: the colombian case. *In*: Y. Guichaoua, ed. *Understanding collective political violence*. London: Palgrave Macmillan UK, 175–195.

Sanín, F.G. and Wood, E.J., 2014. Ideology in civil war. *Journal of Peace Research*, 51 (2), 213–226. doi:10.1177/0022343313514073.

Scott, J.C., 1976. *The moral economy of the peasant: rebellion and subsistence in Southeast Asia*. New Haven: Yale University Press.

Seawright, J. and Gerring, J., 2008. Case selection techniques in case study research. *Political Research Quarterly*, 61 (2), 294–308. doi:10.1177/1065912907313077.

Serrano, M., 2018. Despite economic growth, Colombia continues to be one of the most unequal countries in the world. *UN Periódico Digital*, 13 Dec 2018.
Skaperdas, S., 1992. Cooperation, conflict, and power in the absence of property rights. *American Economic Review*, 82 (4), 720–739.
Sundberg, R. and Melander, E., 2013. Introducing the UCDP georeferenced event dataset. *Journal of Peace Research*, 50 (4), 523–532. doi:10.1177/0022343313484347.
Tezcür, G.M., 2016. Ordinary people, extraordinary risks: participation in an ethnic rebellion. *American Political Science Review*, 110 (2), 247–264. doi:10.1017/S0003055416000150.
Ugarriza, J.E. and Craig, M.J., 2013. The relevance of ideology to contemporary armed conflicts. *Journal of Conflict Resolution*, 57 (3), 445–477. doi:10.1177/0022002712446131.
United Cities and Local Governments (UCLG) and Organisation for Economic Cooperation and Development (OECD), 2016. *Profile-Colombia*. Available from: https://www.oecd.org/regional/regional-policy/profile-Colombia.pdf [Accessed 19 Apr 2023].
Vadlamannati, K.C., 2011. Why Indian men rebel? Explaining armed rebellion in the Northeastern States of India, 1970-2007. *Journal of Peace Research*, 48 (5), 605–619. doi:10.1177/0022343311412409.
Van Baalen, S. and Mobjörk, M., 2018. Climate change and violent conflict in East Africa: integrating qualitative and quantitative research to probe the mechanisms. *International Studies Review*, 20 (4), 547–575. doi:10.1093/isr/vix043.
Weinstein, J.M., 2005. Resources and the information problem in rebel recruitment. *Journal of Conflict Resolution*, 49 (4), 598–624. doi:10.1177/0022002705277802.
Wood, E.J., 2003. *Insurgent collective action and civil war in El Salvador*. Cambridge: Cambridge University Press.
World Bank. 2023. *The world by income and region*. Available from: https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html [Accessed 18 Apr 2023].