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Incomplete Peace and Cocaine Dutch Disease

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Overview

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Introduction

- Vast evidence of conflict and violence effects on multiple development dimensions. A comprehensive literature review was presented by Rohner & Thoening (2021). One of the dimensions frequently explored by scholars is economic development and economic growth.
- In Colombia, due to its internal conflict, a broad evidence of literature has been created since theoretical and empirical perspectives (Cárdenas, 2007; Riascos & Vargas, 2011; Vargas, 2003).
- However, these evidence was mainly focused on economic costs of conflict rather than on the Peace Dividend. There are recent attempts to estimate the Peace Dividend in Northern Ireland measured through house prices and in Colombia through firm entry and credit allocation (Bernal et al., 2022; Besley & Mueller, 2012; de Roux & Martínez, 2021).
- The economic literature has not explore the effects of end-of-conflict on general economic activities in rural areas, mostly exposed to violence, nor the effects of illegal income windfalls in these settings.

Introduction

- The aim of this paper is to explore the effects of the Colombian Peace Agreement on rural economic activity and the effect of the income windfall of the increase in coca crops.
- We employed a difference-in-difference strategy and data from nighttime luminosity data to measure general rural economic activity and the exogenous variation of coca crops employed by Prem et al. (2020) to estimate the effects of the Peace Agreement and of the illegal income windfall.
- Our results suggest a direct effect of the Peace Agreement on rural economic activity (7.3%-11.2%) and an indirect effect driven by the increase in coca crops (9.7%-10.4%) increases by one standard deviation increase in the probability of having incentives to grow coca).

Introduction

- Our results suggest a direct Peace Dividend for the Colombian experience. However, part of the effect is driven by an income windfall of coca crops. Hence, one discussion based on these results is the potential effects on long-run economic growth determinants. Therefore, we explored as mechanisms the effects of the Peace Agreement and of the illegal income windfall on:
  1. Licit crops
  2. Deforestation
  3. Cattle ranching
  4. School enrollment
  5. Homicides
- In terms of the land use dynamics, we found a positive direct effect of the Peace Agreement on licit crops and, a reduction on these crops and an increase in deforestation caused by coca crops incentives.
- Exploring the effects on other long-run growth fundamentals we found short-term negative effects on school enrollment and an increase in homicides rate in pre-FARC municipalities due to increases in coca crops incentives.

Introduction

- The contribution of the paper is threefold: Peace Dividend literature, income windfall effects, and Colombian Peace Agreement evidence.
- Vast evidence on the economic costs of conflict and of acts of violence (Abadie & Gardeazabal, 2003; Álvarez & Rettberg, 2008; Cárdenas, 2007; Collier, 1999; Riascos & Vargas, 2011; Zussman & Zussman, 2006). Additionally, studies also focused in the negative effects on economic growth of military expenditure (Alptekin & Levine, 2012; 2015; Koh, 2007; Mayberry, 2022).
- In Colombia, the cost of conflict between 1999-2003 was of 7.4% of GDP and between 2005-2006 of 9% of GDP (Cárdenas, 2001; Otero, 2007; Pinto et al., 2004).
- In terms of the private sector, there is evidence of the negative effect of conflict or terrorism risk on companies profitability, investment and the positive effect on private security expenditure (Echeverry et al., 2001; Nelson, 2000; Rettberg, 2004; 2006; 2007; 2008).
- For the Colombian case, almost 3 of every 4 companies reported to invest more in productivity, innovation and labor demand in absence of conflict (Rettberg, 2008).

Introduction

- Secondly, income windfall literature has focused on legal booms on economic development and found mixed evidence (references). However, there is scarce evidence, to the best of our knowledge on illegal income windfall.
- In conflict-related outcomes, there is evidence of the positive effects driven by oil exploitation and aid development programs (Crost et al., 2014; Dube & Vargas, 2013; Ross, 2001). However, Dube & Vargas (2013) found negative effects of the coffee boom in Colombia.
- In terms of illicit income shocks, in Afghanistan increases in heroin prices reduced battle-related deaths in 7% and in Colombia the cocaine boom increased violence measured through multiple dimensions (Angrist & Kugler, 2008; Gehring & Langlotz, 2018; Mejía & Restrepo, 2013).
- As for economic outcomes, Angrist & Kugler (2008) and Gehring & Langlotz (2018) explored as mechanisms these variables. In these studies, the authors found positive effects on self-employment income, boys' labor supply, food consumption and asset acquisition. Additionally, found negative effects on boys' school enrollment.

Introduction

- Lastly, we contribute to the economic and political science literature that has explored the effects of the Colombian Peace Agreement. During the negotiation, the private sector had the opportunity to participate in order to discuss the activation and the competitiveness in rural areas (Rettberg et al., 2019).
- In the private sector there is no consensus on the effects of the Peace Agreement as, on the one hand some argue no Peace Dividend as the tax burden remains high due to the financing of the war on drugs. On the other hand, other sectors suggest positive economic effects due to the entry of new firms and new sectors such as foreign tourism (Rettberg et al., 2019).
- Bernal et al. (2022) found positive short-term effects on the entry of new firms, especially on micro-firms from the agricultural sector. De Roux & Martínez (2021) found positive effects on credit to small producers.
- Prem et al. (2020) explored end-of-conflict effects on deforestation. The authors argue an increase in deforestation due to the loss of territorial control after FARC's demobilisation. Our argument is rather different as we explore the effect driven by the exogenous increase in coca crops.

Peace Agreement in Colombia

- Brief history of internal conflict in Colombia
- Peace Process with the FARC was announced on 2012 and signed in 2016. One of the points on the negotiation's agenda was a solution to illicit drugs. In this framework, the PNIS was design.
- In terms of violence there is evidence of reductions on land-mines explosions and victims, and of killings of members of the Armed Forces (Marín Llanes & Vélez, 2022; Perilla et al., 2022). Prem et al. (2020) estimated positive effects on social leaders' killings (2020). Moreover, there is evidence of desirable effects on education outcomes such as dropout rates, graduation rates and test scores, and fertility rates (Guerra-Cújar et al., 2020; Prem et al., 2021).

Data

- Economic activity measured with night lights. Include empirical evidence for their correlation in Colombia.
- Measurement of coca crops prediction basen on Prem et al. (2021).
- Other data employed such as deforestation (Hansen), school dropout, licit crops, amongst others including their source.
- Descriptive evidence: economic growth by coca quantile, maps of clusters.

Methodology

- The aim of the paper is to estimate the direct effect of the ceasefire on economic activity. Moreover, we differentiate the direct effect from the effect lead by the increase in coca crops.
- Evidence of an exogenous increase of coca crops due to the incentives created by a substitution program (Prem et al., 2020). The authors exploit the probability of receiving the program based on poverty and coca crops density.
- We use the probability of the program to measure the exogenous increase in coca crops.
- With the available information, we are able to disentangle rural from urban economic activity. Hence, we focus in rural economic activity as it is directly linked with areas controlled by the FARC and where the illicit boom occurred. Urban and municipality overall economic activity are used in placebo tests.

Methodology

- Baseline model employing a difference-in-difference strategy:

$$y_{m,t} = \mu_m + \mu_t + \delta_1 FARC_m * Cease_t + \beta X_{m,2011} + \epsilon_{m,t} \quad (1)$$

$$y_{m,t} = \mu_m + \mu_t + \delta_1 FARC_m * Cease_t + \delta_2 CocaIncentives_m * Cease_t + \beta X_{m,2011} + \epsilon_{m,t} \quad (2)$$

$y_{m,t}$: logarithm of rural night lights in municipality m in period t.
μ_m and μ_t: municipality and year fixed effects.
$FARC_m$: dummy variable equals 1 if FARC had presence in municipality m prior to the ceasefire.
$CocaIncentives_m$: the estimated probability of receiving the substitution program that exogenously increased coca crops in municipality m.
$Cease_t$: dummy variable equals 1 2015 on-wards.
$X_{m,2011}$: covariates matrix including municipalities controls in pre-treatment period interacted with year fixed effects.
$\epsilon_{m,t}$: error term cluster at the municipality level

Methodology

- We complemented our empirical strategy following Martínez & De Roux (2018) as they consider the negotiation period as treated. We followed both methodologies in order to determine consistent results.
- In the dynamic model, in order to approximate the identification assumption, the treatment begins in 2012 to account for potential anticipation effects created by the negotiation period.

$$y_{m,t} = \mu_m + \mu_t + \sum_{t=-K}^{2010} \gamma_t d_m^t + \sum_{t=2012}^{L} \phi_t d_m^t + \beta X_{m,2011} + \omega_{m,t} \tag{3}$$

d_m^t: corresponds to the $FARC_m * Cease_t$ and $CocaIncentives_m * Cease_t$ interactions.

Main Results

Table: Cease fire effect on rural economic activity (night lights in log)

VARIABLES	Rural night lights (log)			
FARC * Cease	0.073**	0.103***	0.078**	0.112***
	(0.029)	(0.032)	(0.031)	(0.034)
CocaIncentives * Cease		1.011***		1.085***
		(0.316)		(0.335)
FARC * CocaIncentives * Cease		-0.918***		-0.998***
		(0.342)		(0.362)
FARC * Negotiation			0.043*	0.071***
			(0.022)	(0.024)
CocaIncentives * Negotiation				0.562***
				(0.174)
FARC * CocaIncentives * Negotiation				-0.615***
				(0.196)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	29,268	29,214	29,268	29,214
R-square	0.891	0.891	0.891	0.891

Clustered standard errors, at the municipality level, in parenthesis. No-FARC pre-treatment mean: 2.177.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Main Results: Dynamic models

Figure: Dynamic effects of FARC presence

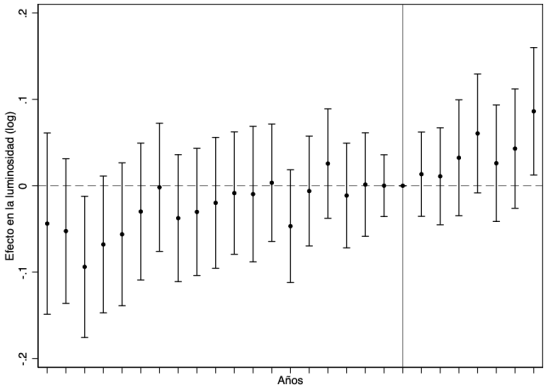
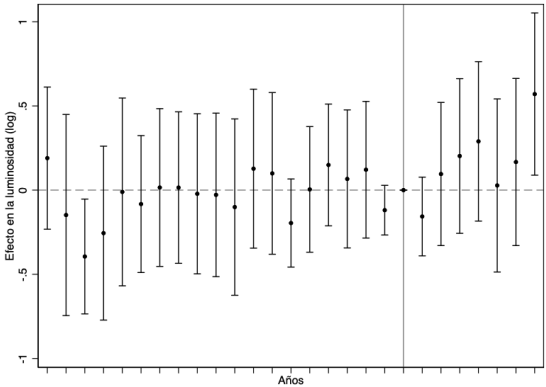


Figure: Dynamic effects of Coca Incentives



Main Results: Placebo tests with urban economic activity

Table: Cease fire effect on urban economic activity (night lights in log)

VARIABLES	Urban night lights (log)			
FARC * Cease	0.016	0.019	0.013	0.015
	(0.027)	(0.031)	(0.028)	(0.033)
CocaIncentives * Cease		-0.175		-0.226
		(0.300)		(0.313)
FARC * CocaIncentives * Cease		0.086		0.120
		(0.308)		(0.323)
FARC * Negotiation			-0.027	-0.029
			(0.017)	(0.019)
CocaIncentives * Negotiation				-0.386***
				(0.129)
FARC * CocaIncentives * Negotiation				0.256*
				(0.150)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	29,268	29,214	29,268	29,214
R-square	0.938	0.938	0.938	0.938

Clustered standard errors, at the municipality level, in parenthesis.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Main Results: Placebo tests with total economic activity

Table: Cease fire effect on municipality economic activity (night lights in log)

VARIABLES	Total municipality night lights (log)			
FARC * Cease	0.025	0.028	0.022	0.024
	(0.026)	(0.030)	(0.028)	(0.032)
CocaIncentives * Cease		-0.091		-0.136
		(0.286)		(0.298)
FARC * CocaIncentives * Cease		0.030		0.060
		(0.295)		(0.308)
FARC * Negotiation			-0.024	-0.025
			(0.017)	(0.018)
CocaIncentives * Negotiation				-0.347***
				(0.120)
FARC * CocaIncentives * Negotiation				0.228
				(0.143)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	29,268	29,214	29,268	29,214
R-square	0.943	0.944	0.943	0.944

Clustered standard errors, at the municipality level, in parenthesis.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Main Results: interpretation

- We find a positive effect of the cease fire on the rural economic activity. Moreover, this effect is partially driven by the incentives to increase coca crops.
- The magnitudes of the direct and the indirect effects are similar. The cease fire increase the rural economic activity by 7.3% - 11.2% (3.4%-5.2% in terms of pre-treatment mean). In terms of the indirect effect through the illicit economy we found that a one standard deviation increase in the incentives, rural economic activity increased by 9.7% - 10.4% (46.4%-49.8% in terms of pre-treatment mean).
- We do not find differentiated effects by quantiles of coca crops incentives. Additionally, doing placebo tests we do not find effects on urban nor total economic activity. Hence, the effects are concentrated in the rural areas, where the FARC had presence and where the coca crops expansion occurred.

Mechanisms: methods

- The purpose of this section is to determine the changes in other dimensions in territories with previous presence of the FARC and with increasing incentives to cultivate coca crops. We explore the effects of the ceasefire in dimensions that could explain the increase on rural economic activity:
  1. Licit crops
  2. Deforestation
  3. Cattle ranching (t+1)
- Moreover, as we found a positive effect on rural economic activity, it is important to explore effects on long-run growth fundamentals in order to have an idea if the estimated effects could sustained:
  1. School enrollment
  2. Homicides

Mechanisms: Licit crops

Table: Cease fire effect on licit crops

VARIABLES	Licit crops (share of municipality)			
FARC * Cease	0.129*	0.194**	0.167**	0.242**
	(0.073)	(0.091)	(0.083)	(0.103)
CocaIncentives * Cease		-0.077		-0.047
		(0.249)		(0.291)
FARC * CocaIncentives * Cease		-0.566*		-0.687*
		(0.318)		(0.369)
FARC * Negotiation			0.175***	0.226***
			(0.064)	(0.080)
CocaIncentives * Negotiation				0.141
				(0.245)
FARC * CocaIncentives * Negotiation				-0.563**
				(0.285)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	19,512	19,476	19,512	19,476
R-square	0.993	0.993	0.993	0.993

Clustered standard errors, at the municipality level, in parenthesis. No-FARC pre-treatment mean: 1.599.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Mechanisms: Dynamic effects on licit crops

Figure: Dynamic effects of FARC presence

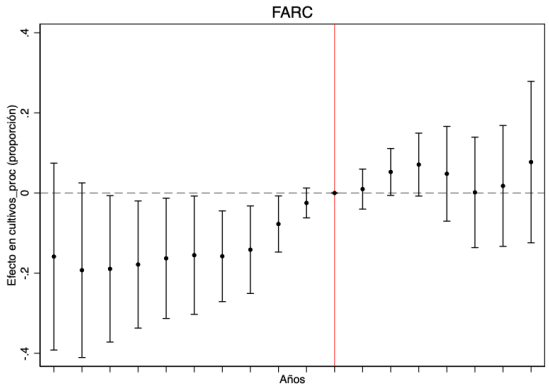
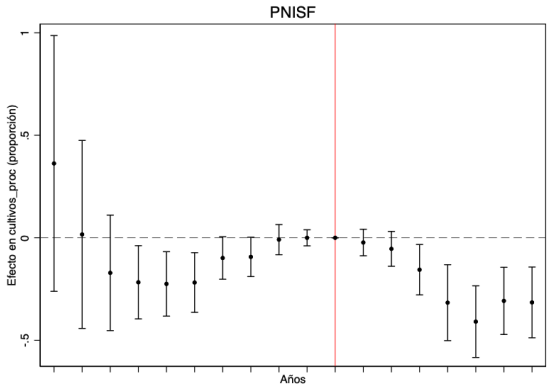


Figure: Dynamic effects of Coca Incentives



Mechanisms: Deforestation

Table: Cease fire effect on deforestation

VARIABLES	Deforestation (share of municipality)			
FARC * Cease	0.012	-0.027	0.018	-0.022
	(0.027)	(0.027)	(0.028)	(0.028)
CocaIncentives * Cease		0.803**		0.859**
		(0.355)		(0.384)
FARC * CocaIncentives * CeCeasese		-0.134		-0.163
		(0.426)		(0.460)
FARC * Negotiation			0.028**	0.026**
			(0.012)	(0.013)
CocaIncentives * Negotiation				0.260
				(0.166)
FARC * CocaIncentives * Negotiation				-0.138
				(0.187)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	19,512	19,476	19,512	19,476
R-square	0.545	0.550	0.545	0.551

Clustered standard errors, at the municipality level, in parenthesis. No-FARC pre-treatment mean: 0.211.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Mechanisms: Dynamic effects on deforestation

Figure: Dynamic effects of FARC presence

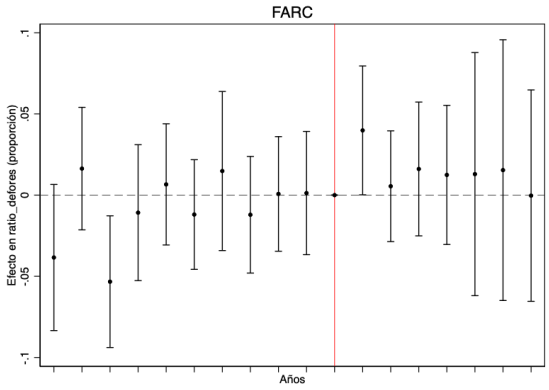
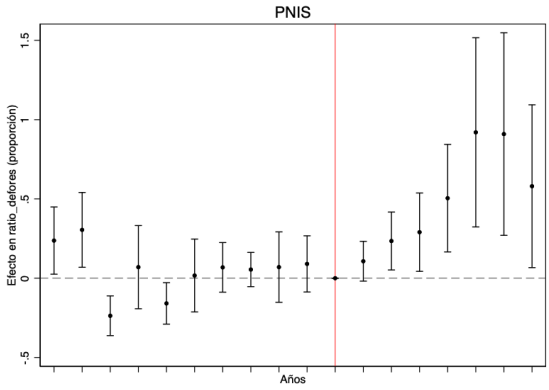


Figure: Dynamic effects of Coca Incentives



Mechanisms: Cattle ranching

Table: Cease fire effect on cattle ranching

VARIABLES	Cattle ranching (log)			
FARC * Cease	0.081**	0.033	0.112**	0.055
	(0.041)	(0.042)	(0.049)	(0.051)
CocaIncentives * Cease		-0.019		-0.044
		(0.258)		(0.321)
FARC * CocaIncentives * Cease		0.467		0.564
		(0.337)		(0.389)
FARC * Negotiation			0.083**	0.060*
			(0.032)	(0.034)
CocaIncentives * Negotiation				-0.067
				(0.212)
FARC * CocaIncentives * Negotiation				0.260
				(0.268)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	11,910	11,888	11,910	11,888
R-square	0.932	0.930	0.932	0.930

Clustered standard errors, at the municipality level, in parenthesis. No-FARC pre-treatment mean: 8.887.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Mechanisms: Dynamic effects on cattle ranching

Figure: Dynamic effects of FARC presence

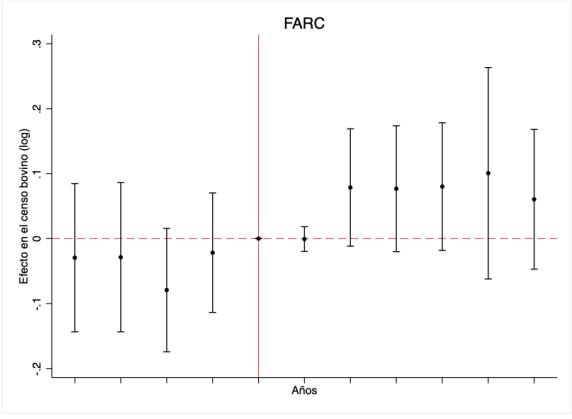
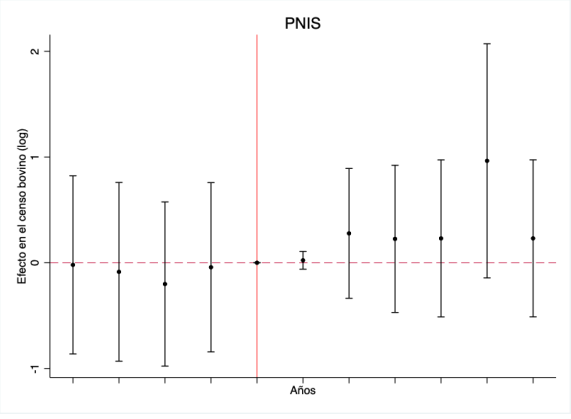


Figure: Dynamic effects of Coca Incentives



Mechanisms: School enrollment

Table: Cease fire effect on school enrollment

VARIABLES	School enrollment (log)			
FARC * Cease	0.035	0.035	0.040	0.042
	(0.030)	(0.034)	(0.034)	(0.039)
CocaIncentives * Cease		-0.144		-0.099
		(0.327)		(0.401)
FARC * CocaIncentives * Cease		0.098		0.040
		(0.335)		(0.408)
FARC * Negotiation			0.026	0.046
			(0.029)	(0.034)
CocaIncentives * Negotiation				0.279
				(0.453)
FARC * CocaIncentives * Negotiation				-0.356
				(0.455)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	24,793	24,761	24,793	24,761
R-square	0.825	0.822	0.825	0.822

Clustered standard errors, at the municipality level, in parenthesis. No-FARC pre-treatment mean: 7.818.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Mechanisms: Dynamic effects on school enrollment

Figure: Dynamic effects of FARC presence

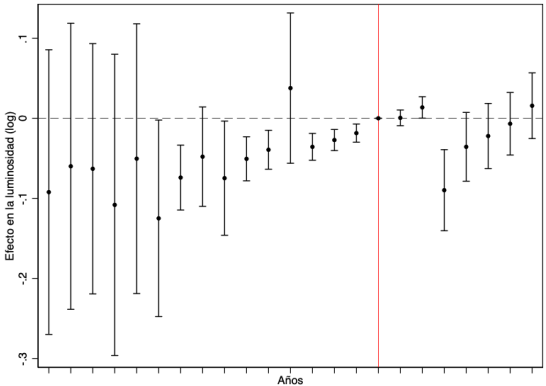
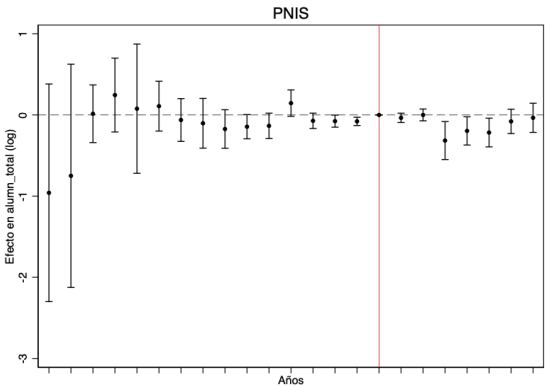


Figure: Dynamic effects of Coca Incentives



Mechanisms: Homicides rate

Table: Cease fire effect on homicides rate

VARIABLES	Homicides rate (per 100.000 inhabitants)			
FARC * Cease	-2.058	-5.900**	-2.312	-7.353**
	(2.038)	(2.359)	(2.846)	(3.158)
CocaIncentives * Cease		-73.970**		-77.702**
		(34.288)		(39.524)
FARC * CocaIncentives * Cease		82.477**		95.967**
		(35.345)		(41.252)
FARC * Negotiation			-0.423	-2.422
			(2.061)	(2.149)
CocaIncentives * Negotiation				-6.221
				(17.329)
FARC * CocaIncentives * Negotiation				22.485
				(19.970)
Municipality fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Baseline controls with year fixed effects	✓	✓	✓	✓
Observations	9,756	9,738	9,756	9,738
R-square	0.617	0.618	0.617	0.618

Clustered standard errors, at the municipality level, in parenthesis. No-FARC pre-treatment mean: 24.221.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Mechanisms: Dynamic effects on homicides rate

Figure: Dynamic effects of FARC presence

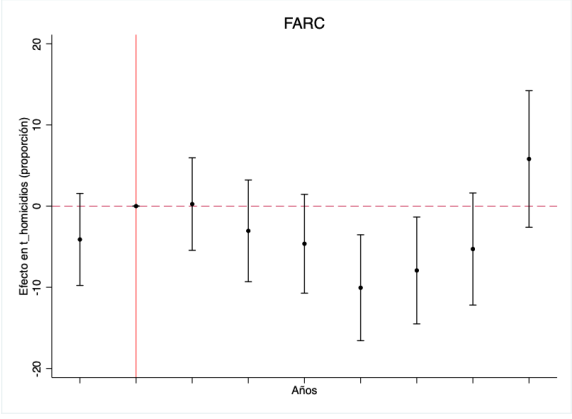
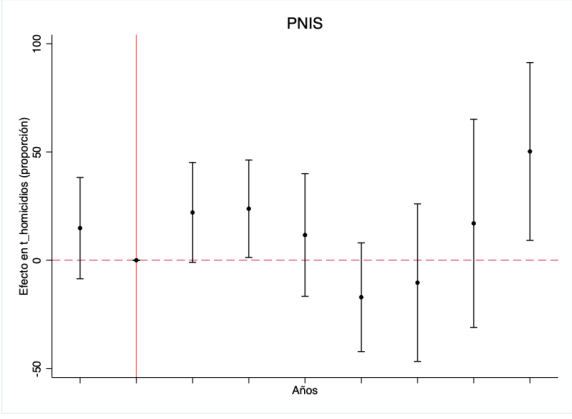


Figure: Dynamic effects of Coca Incentives



Mechanisms: summary

- We found an increase in licit crops in municipalities with previous presence of the FARC (0.13 pp - 0.24 pp; 8.1%-15.1% in pre-treatment mean). However, in these municipalities a one standard deviation increase in coca incentives reduced licit crops (0.05 pp - 0.07pp; 35.4%-43% in pre-treatmen mean). Hence, in municipalities with previous FARC presence a substitution effect occurred of licit crops for coca crops.
- In terms of deforestation, we found an expansion of the agrarian frontier in municipalities without presence of the FARC due to the incentives for coca crops. We estimated that a standard deviation increase in these incentives increased the deforested area by 0.8 pp (381%-407% in pre-treatment mean).
- Lastly, we do not find any effects on cattle ranching. Even if we find null effects on cattle ranching it could be because of the short time horizon between the treatment and cattle ranching.
- **In municipalities with FARC presence there was an increase in licit crops after the cease fire and a substitution of licit crops for coca crops. Additionally, in municipalities without FARC presence, there was an expansion of the agrarian frontier due to increases in coca crops.**

Mechanisms: summary

- We do not find average effects on school enrollment. However, since the year of the cease fire we found for 3 consecutive periods negative effects on school enrollment due to increases in coca crops incentives.
- Homicides rate decreased by the cease fire in municipalities with presence of the FARC and due to increases in coca crops incentives. However, a standard deviation increase in coca crops incentives in pre-FARC municipalities increased the homicides rate by 82-96.
- **In average, we do not find desirable effects on school enrollment nor on homicides rate. Hence, the economic windfall caused by the cease fire and the coca economy did not affect long-run growth fundamentals.**

Conclusions

- Recap of the results: rural economic activity growth driven by a direct cease fire effect and an expansion of the illicit economy.
- Different dynamics of growth conditioning on pre-FARC presence. However, do not find effects on long-run development fundamentals. Hence, these effects could be limited to the short term and affecting determinants of development such as human capital accumulation.
- Mixed evidence of conflict and economic development. We exploit a quasi-natural experiment and differentiate by licit and illicit economies.