

# The effect of mass migration on malaria incidence: Evidence from the Venezuelan refugee crisis



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## ABSTRACT

This paper explores the effect of the recent Venezuelan exodus on malaria outbreaks in the Amazon Rainforest. In the last years, migration skyrocketed due to recurrent economic and political crises.

Migrants heading to Brazil commonly travel by land, crossing the Brazil – Venezuela Border in Pacaraima - Roraima. The border is in the Amazon region, a malaria endemic place, home of numerous species of malaria mosquitoes. By exploiting mass migration in 2015 as a quasi-experiment, I find that incidence was 18.59% higher in the nearest municipality to the Venezuelan border after the crisis.

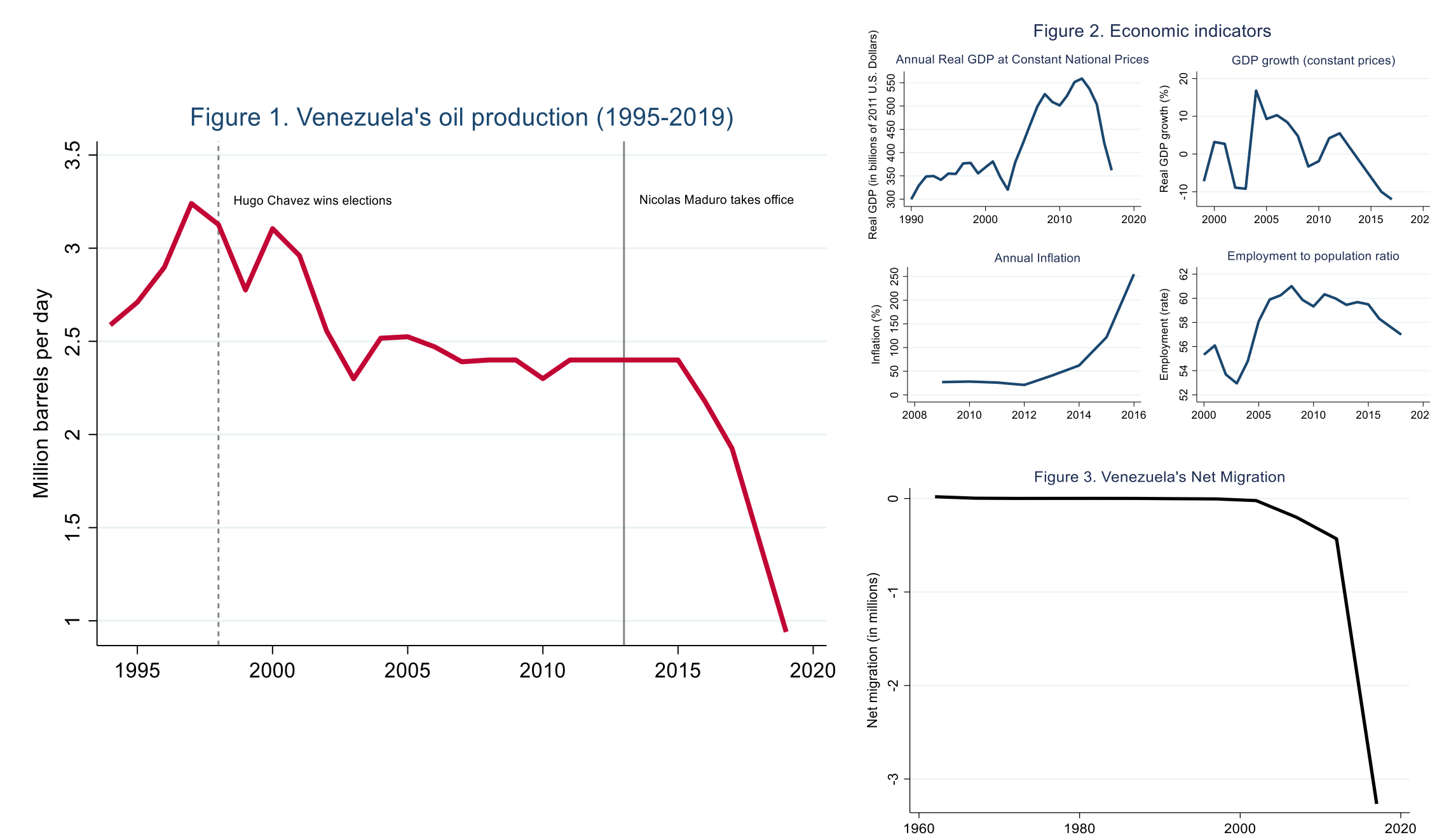


Source: Policia Colombiana  
A Venezuelan migrant stands over a stove at a makeshift camp in Boa Vista, Brazil  
UN and Brazilian Army camp for Warao people  
Photographer: Andre Coelho/Bloomberg  
Fanny Lothaire - France 24, 2018

## BACKGROUND

The Era of Human Mobility

- Conflict refugees: Syrians, Myanmar Rohingyans, Somali, The “boat” people
- Climate change refugees: Mozambicans and Pacific Islanders
- Economic refugees: Central Americans migrating to the US
- Venezuelans escaping the economic and political crisis



## METHODS AND DATA

Identification strategy: Exploit the Venezuelan economic crash as exogenous variation to estimate the incidence of migration on malaria incidence under a difference-in-difference approach

$$malaria_{mt} = \alpha_0 + \delta_1 Postcrisis_{mt} + \beta X_{mt} + \gamma_m + \lambda_t + \theta_{mt} + \epsilon_{mt} \quad (1)$$

$malaria_{mt}$  is malaria in rates  
 $Postcrisis_{mt}$  is a dummy variable equivalent to 1 for the years after the crash in municipalities with high migration concentration  
 $X_{mt}$  is a vector of controls  
 $\gamma_m$ ,  $\lambda_t$  and  $\theta_{mt}$  are the fixed effects, time invariant unobserved Characteristics, year fixed effects, and location time specific effects  
 $\delta_1$  is the coefficient of interest and measures the change in malaria rates after the economic crash within treatment  
 $\epsilon_{mt}$  is the error term

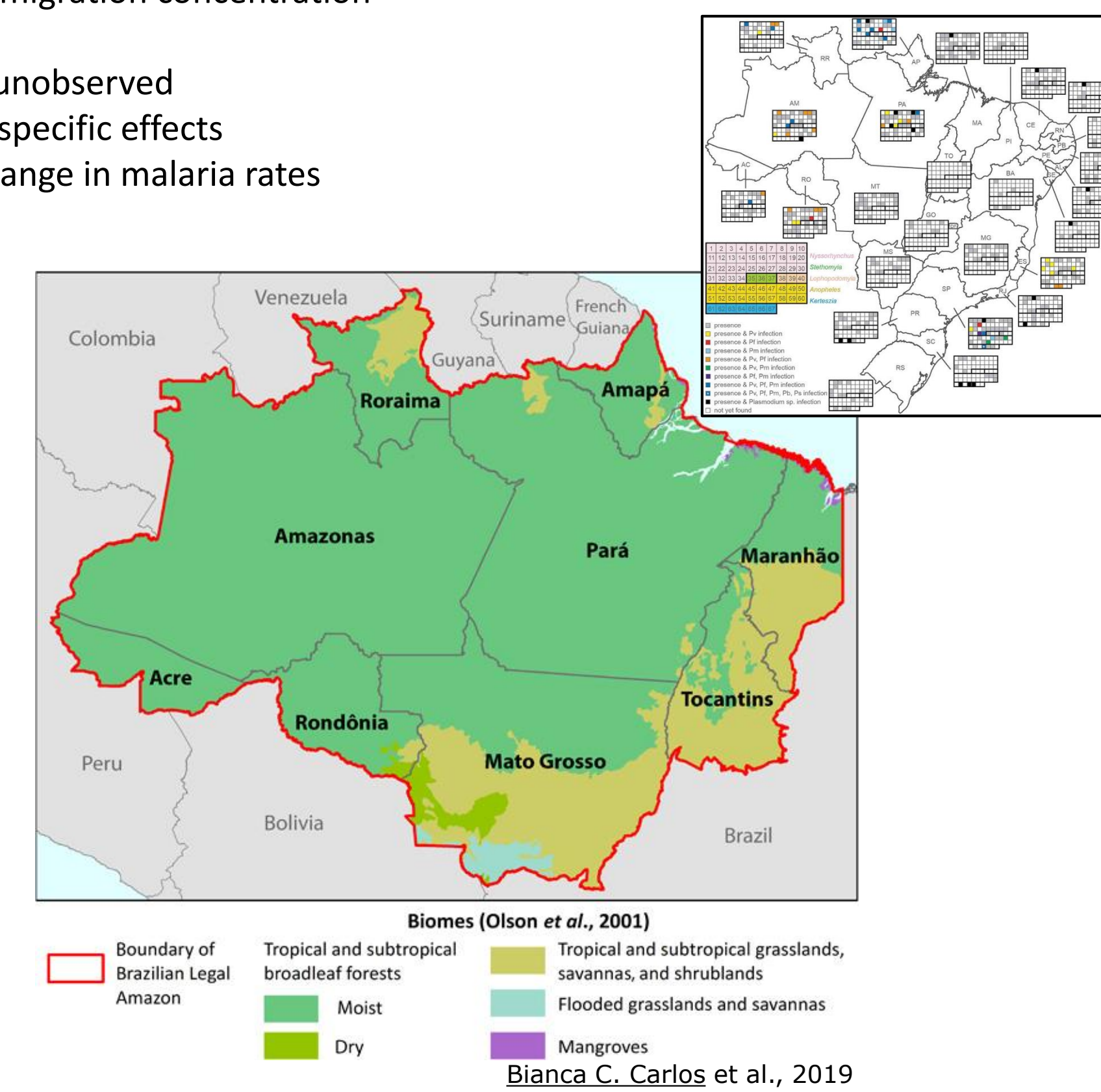
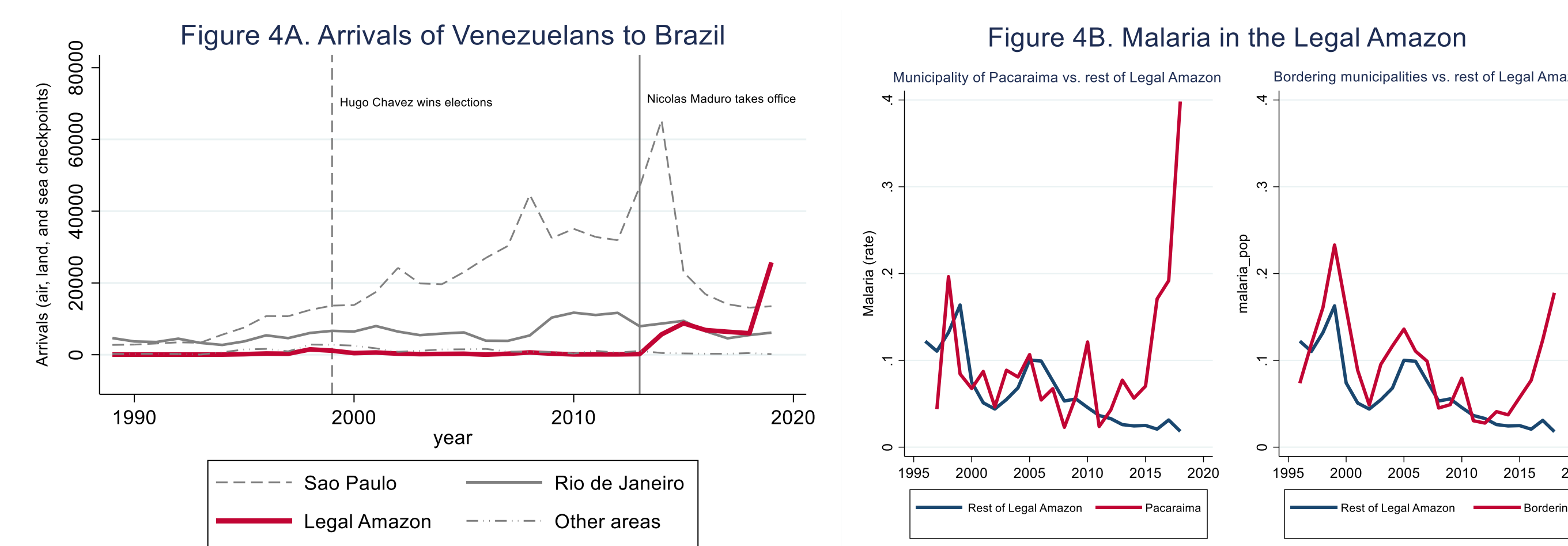


Figure 3. The Legal Amazon and malaria mosquitos' presence

Panel data consists of 583 municipalities observed over 22 years (1996-2018)

1. Reported cases of malaria - SIVEP, Brazilian Ministry of Health
2. Venezuelan arrivals to Brazil – Brazilian Federal Police
3. Sociodemographic covariates - Brazilian Ministry of Geography
4. Weather variables - Brazilian National Weather Agency

➔ To what extent is this causal?  
 Is transmission of malaria within the refugee population or is it among the locals?



## RESULTS

a) Effect of migration: Malaria rates increase significantly

	Table 1. Main results for Municipality of Pacaraima			
	Rates		Level	
Post crisis	0.1859** (0.0630)	0.1394** (0.0745)	2489.767*** (679.8487)	2351.769* (1462.45)
Towns	583			
Baseline controls	No	Yes	No	Yes
Municipality FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Municipality specific time FE	No	Yes	No	Yes

b) Disease transmission occurs within groups instead of across groups

$$y_{imt} = \alpha_i y_{imt-1} + \gamma_i y_{jmt-1} + \epsilon_{imt} \quad (2)$$

$$y_{jmt} = \alpha_j y_{jmt-1} + \gamma_j y_{imt-1} + \epsilon_{jmt} \quad (3)$$

$i$  and  $j$ : Group,  $m$ : Municipality

$t$ : Year,  $y$ : Infection

$y_{imt}$ : Rate of infection in municipality  $m$  at year  $t$

Table 2. Bond-Arellano regression for disease transmission			
Rate sick Brazilians		Rate sick Venezuelans	
sick Brazilians		sick Venezuelans	
t-1	0.1758*** (0.0414)	t-1	0.0897*** (0.0101)
sick Venezuelans		sick Brazilians	
t-1	0.2908 (0.7154)	t-1	-0.00030 (0.0003)
Towns	583		
Baseline controls	Yes		Yes

## CONCLUSIONS

Migration after the Venezuelan economic crash increases significantly the cases of malaria

- The impact on malaria is not driven by a “border effect”

The Bond-Arellano regressions show that disease transmission occurs within populations rather than across populations

If trends continue, changes in the geography of malaria are anticipated: low endemic places can promptly become epidemic places

A cost – efficient governmental policy would potentially be to support better conditions in refugee camps

- Less cases of malaria, thus less costs associated with prevention and intervention and investment
- Healthy migrants able to work and study and fully integrate to society

