HEROES OR VILLAINS? AGRIBUSINESS LEADERS IN THE AMAZON REGION

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ABSTRACT

In recent years, the Amazon rainforest has faced voracious depletion due to logging and farming activities. These activities are often justified as necessary for economic development in the region. However, effective leadership, particularly at the local level, can play a crucial role in promoting simultaneously both economic growth and ecological sustainability. This study examines the effects of leaders' occupational background in agribusiness on economic development and environmental preservation. We employ a Regression Discontinuity Design (RDD) to compare the performance of marginally elected (almost randomly) agribusiness leaders with non-agribusiness leaders in terms of new firm creation and deforestation rates in Brazilian Amazon municipalities from 2004 to 2016. Our findings suggest that agribusiness leaders are more effective than their non-agribusiness counterparts in promoting the creation of new businesses in their municipalities. This increased economic activity has not necessarily been accompanied by higher deforestation rates. The analysis of mechanisms shows the importance of fiscal policies, which are under the control of local leaders, in promoting economic prosperity without sacrificing environmental sustainability. This study underscores the need to move beyond simplistic notions of "heroes" and "villains" in the quest to reconcile economic and ecological objectives as aimed by the United Nations Sustainable Development Goals.

Keywords: Sustainable Development Goals, Amazon rainforest, Regression Discontinuity Design, Agribusiness leaders, Occupation background, New Institutional Economics.

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INTRODUCTION

Are agribusiness leaders "heroes" or "villains" to the Amazon rainforest? The literature in management has developed extensive research aiming to understand how organizations might positively contribute to the achievement of the United Nations Sustainable Development Goals (SDGs), seeking to address the "Grand Challenges" of our time by reconciling economic, social, and ecological objectives (George et al., 2016, 2023). The literature on leadership, however, has demonstrated that the occupational background of leaders might influence their decisions on whether to prioritize economic or ecological goals (Ferdig, 2007; Regine & Lewin, 2000; Senge et al., 2008). This study aims to understand the effects of elected leaders, whose background is in agribusiness, on economic development and environmental conservation in a critical ecological area of the world, the Amazon rainforest.

The literature on leadership has established that sustainable leaders are defined as individuals who take responsibility and action on sustainability challenges (Ferdig, 2007). They act to lead outcomes that nurture, support, and sustain economic, social, and environmental contexts. In fact, consistent with this definition, only a new type of leadership can deliver sustainability (Regine & Lewin, 2000; Senge et al., 2008). Yet, the literature on sustainable leadership is still scant (Cox, 2005; Gustafson, 2004; Quinn & Dalton, 2009), and the few existing studies focus on for-profit organizations, and not on the government nor NGOs (Brown, 2011).

Sustainability has been historically considered diametrically opposed to agribusiness in the Amazon rainforest region as large areas of the old forest have been depleted and repurposed for cattle raising and conventional agriculture use (Nazareno & Laurance, 2020; Rajão et al., 2020; Souza-Rodrigues, 2018). At the same time, agribusiness chains are globally integrated and face increasing international pressure to comply with the ecological expectations of consumers and

investors worldwide (The Economist, 2020). Therefore, it is unclear how agribusiness leaders could affect economic growth and ecological preservation in the Amazon.

To evaluate the effect of these leaders, this study makes use of a quasi-experimental approach. Using a Regression Discontinuity Design (RDD), the study compares agribusiness leaders who were elected within a narrow margin of votes vs. non-agribusiness counterparts. This close electoral margin functions as a coin toss, in other words, as if the election result was random. This feature helps us control for all observable and non-observable factors and pin down the effects on economic development and environmental preservation to a unique element, the leader's occupational background in agribusiness.

The results show that agribusiness leaders have a significant positive effect on the economic performance of their communities, mainly through the superior creation of new firms in the municipalities they manage. Agribusiness leaders are not significantly different from other leaders regarding forest depletion. An analysis of mechanisms shows that agribusiness leaders have achieved a positive economic effect without harming the environment due to their superior management of municipal fiscal policies. Through investments in agriculture, infrastructure, and urbanism, these leaders have contributed to dynamizing local economies without increasing deforestation rates more than their non-agribusiness counterparts would have done.

The discoveries reported in this paper inform the literature on leadership, sustainability, and New Institutional Economics (NEI). First, it shows that individuals' backgrounds matter, but not necessarily in a deterministic way. Second, it shows that leaders operating in ecologically sensitive areas can and should use managerial tools, such as investments and local policies, to reconcile economic growth with environmental preservation. Finally, the study reinforces the importance of macro institutional features promoting ecological protection to influence local

leaders' progressive behavior. Altogether, this research shows that intelligent management combined with a robust institutional environment fosters reconciliation between environmental and economic objectives.

OCCUPATIONAL BACKGROUND AND LEADERSHIP

Local leaders (i.e., mayors) act as 'managers' of their municipalities (Steyvers, 2013). Hambrick and Mason (1984) stated that the functional background of these executives is an essential source of capabilities since these decision-makers process information based on their values and experiences. According to Dearborn and Simon (1958), Walsh (1988), and Westphal and Fredrickson (2001), the functional background of managers has a direct impact on how they define problems and implement strategies. In other words, their occupations will reflect the organization's objectives and directions. Upper echelons theory (Hambrick & Mason, 1984) suggests that organizations reflect their top management, and organizational outcomes reproduce the value's cognitive bases of powerful actors in their structure. Many studies support this theory. For instance, previous studies have found that certain traits and characteristics of CEOs significantly impact their decisions and, ultimately, organizational outcomes. Factors such as tenure, ownership (Lim and Lee, 2019), political affiliation (Liu and Jiang, 2020), and experience (Li and Singal, 2017) have an impact on organizational results, including corporate financial performance.

The upper echelons theory has also been associated with environmental performance. For example, there are a series of studies that show how gender (in this particular case, measured by board diversity) influences the ecological performance of a firm (Birindelli et al., 2019; Elmagrhi et al., 2019; Martín & Herrero, 2020; Orazalin & Mahmood, 2021; Post et al., 2015). Similarly, the occupational background was found to impact how managers think about sustainability

(Ibrahim et al., 2000, 2007) and how it influences social performance (Bai, 2013). Studies have found that boards with members who have green corporate human capital and green relational capital will perform better environmentally (Cowden & Bendickson, 2015). Similarly, environmental committees influence corporate social performance (Dixon-Fowler et al., 2017), and executives with previous experience in environmental issues affect corporate ecological performance (Homroy & Slechten, 2019).

The application of this theory is not only valid for for-profit organizations. Studies have shown that a political candidate's occupational background and gender influence voters' perceptions of competence and what kind of initiatives they will support (Coffé & Theiss-Morse, 2016). For example, Americans tend to view businesspeople as more capable, competent, and efficient (Campbell & Cowley, 2014), which influences their voting behavior. Background experience of politicians has also been associated with their willingness to use force (Carter & Smith, 2020; Horowitz et al., 2015; Horowitz & Stam, 2014), their likelihood to engage in nuclear cooperation agreements (Berkemeier, 2019), and even their willingness to support immunization during a health crisis, such as COVID-19 pandemic (Cabral et al., 2021; Green et al., 2020). In our case, we focus on the agribusiness background of leaders in the Amazon rainforest region as this might affect their likelihood of taking action to mitigate global warming effects (Fearnside et al., 2009).

THE AMAZONIAN CONTEXT AND THE AGRIBUSINESS LEADERS

The Amazon rainforest covers an area equivalent to 40% of South America and extends through eight different countries. The area contains over 1.4 billion acres of forests, corresponding to half of the planet's remaining tropical forests,[5] which makes it an important

[5] Available at https://www.worldwildlife.org/places/amazon. Accessed on December 01st, 2022.

asset in mitigating global warming effects (Fearnside et al., 2009). The Amazon's population exceeds 25 million people only in Brazil, including over 200 thousand indigenous people distributed among more than 70 groups.[6] The region is also well-known for its livestock production, representing over 40% of Brazil's total production, and for its agricultural production, with soybean and corn as the most cultivated products (Stabile et al., 2020).

This duality between traditional communities where the forest is preserved and agricultural frontiers where the forest has been depleted increases the complexity of the regional dynamics. It is easy to identify critical players in the Amazon region, for instance: (a) indigenous groups, who aim to preserve their cultural identities and maintain their reserves intact, as well as traditional communities which focus on better living conditions and minimal impact on deforestation; (b) agribusiness developers, who focus on higher returns on their investments but also have recently become more concerned about the environmental impacts of their activities due to market restrictions applied to companies that are not willing to comply with non-deforestation agreements. These groups have interests that often conflict (Alston, Libecap, & Mueller, 2000; Alston & Mueller, 2010; Monteiro, Yeung, Caleman, & Pongeluppe, 2019). For instance, contentious and even physical clashes regularly occur between indigenous groups and agribusiness producers, particularly regarding the expansion of the agricultural frontier and the use of land previously covered by forest (Rajão et al., 2020; Souza-Rodrigues, 2018; Strand et al., 2018).

The tension between groups in the Amazon region is usually reinforced or mitigated by the macro institutional framework. Historically, the Brazilian government has seen the Amazon

[6] Available at https://www2.camara.leg.br/atividade-legislativa/comissoes/comissoes-permanentes/cindra/amazonia-legal/mais-informacoes-sobre-a-amazonia-legal. Accessed on December 1st, 2022.

rainforest as a hurdle to the region's economic development (Mendes et al., 1989). Federal administrations (from 2003 to 2016) had a countercyclical approach, with the implementation of a real-time deforestation detection system (a.k.a. DETER, in 2004) and investments in command and control operations to assure environmental preservation (Souza-Rodrigues, 2018). These administrations designed rules and regulations, such as a revisited national legal Forest Code (Law nº12,651/2012), aiming to foster a reconciliatory position between economic development and ecological protection. These changes in the "rules of the game" (North, 1990, 1991) contributed to a steady reduction in total deforested areas during those years (see Figure 1). However, more recent administrations (2017-2022) turned many of these policies around, reinforcing a conflictive view of forest preservation and economic development.

Thus, it would be essential to appreciate whether the institutional incentives, particularly the ones developed from 2004 to 2016 (our period of analysis), explicitly affected the behavior of agribusiness leaders to recognize potential complementarities between ecology and economy.

Insert Figure 1 about here

In the academic domain, research has also pointed to similar tensions concerning livestock growth, agricultural production, and deforestation (Barreto et al., 2008; Rivero et al., 2009). While some studies have addressed the existing conflict due to the expansion of production limits through legal reserves and protected areas (Kauano et al., 2020; Kröger, 2020; Paiva et al., 2020; Yanai et al., 2020), others have examined the relationship between credit policies and deforestation rates (Assunção et al., 2020). These studies have questioned whether the implementation of policy measures has influenced how cattle ranchers and soybean producers

have expanded their activities and whether increased agricultural production can occur despite the rise in deforestation (Macedo et al., 2012).

The majority of these studies reinforce an inherent tradeoff between economic growth through conventional agriculture expansion and ecological preservation of the old forest. However, some studies argue that there are ways to reconcile economic and environmental objectives. For instance, scholars have proposed ways that could lead to a reduction in deforestation while increasing agricultural production, for example, by increasing the productivity of the current agricultural areas (Brandão et al., 2020; Stabile et al., 2020). Also, research has demonstrated that Coasean bargaining with local communities might lead to higher profits and superior forest preservation (Boehe et al., 2014; Lazzarini et al., 2020; McGahan & Pongeluppe, 2021). Interestingly, however, these studies share a similar narrative in which cattle ranchers and conventional agricultural producers are usually the ones depleting the forest for private gains (Börner et al., 2014; Fearnside, 1993; Gibbs et al., 2016; Jusys, 2016; Nepstad et al., 2014; Verburg et al., 2014).

Given this evidence, conventionally, agribusiness leaders in Brazil are considered harmful to the environment, particularly in the Amazon Region (Rosano-Peña et al., 2014). This is the case since agricultural development in Brazil has increased production and productivity at the expense of increasing CO_2 emissions and the depletion of extensive forested areas in favor of agricultural and livestock farming in those locations (Souza-Rodrigues, 2018). Therefore, based on the upper echelon theory, we would expect agribusiness leaders to be more damaging to the environment than their counterparts not engaged in agribusiness activities. Similarly, we would expect these leaders to have superior economic development than their non-agribusiness counterparts, given their focus on fostering market-oriented agricultural activities in those locations.

However, previous studies have also emphasized that investors, consumers, and the general public are closely observing this sector because of its controversial environmental issues (Dos Santos et al., 2021; Nazareno & Laurance, 2020). Agribusiness organizations are under increasing pressure to implement social responsibility aiming to improve stakeholder relations (Luhmann & Theuvsen, 2016). Findings about agribusiness environmental disclosure in Brazil suggest local legitimacy concerns (Dos Santos et al., 2021). Furthermore, as Rajão et al. (2020) suggest, Brazil's inability to tackle deforestation puts its agribusiness' future at risk as international consumers pressure for superior environmental standards. This increases the likelihood that sustainable practices would affect agribusiness leaders' decisions, particularly given their effects on the financial viability of their core business (Rankin et al., 2011).

To this end, the effects of agribusiness leaders in the Amazon rainforest are unclear, particularly when considering their causal effects. This is precisely what this study attempts to address.

DATA AND METHODS

Data and Measures

To test if the occupational background of local leaders will have an impact on business creation and deforestation, we use data from nine different sources: (i) the Brazilian Supreme Electoral Court (*TSE*), (ii) the Brazilian Annual Report of Social Information (*RAIS*), (iii) the Brazilian Ministry of Labor and Employment, (iv) Brazilian Ministry of Health (*DATASUS*), (v) the IBGE's Automatic Recovery System (*SIDRA*), (vi) the Brazilian Municipal Basic Information Survey (*MUNIC*), (vii) the Brazilian Satellite Monitoring System (*PRODES, INPE*), (viii) the Brazilian National Treasury, and (ix) the Brazilian Map of Civil Society Organizations (*IPEA*).

The labels, detailed information about the construction, and source for each one of the variables used in our investigation (including covariates) are found in the Online Appendix (please see Online Appendix A).

Independent variable: Agribusiness leader (dummy). In our database, we can identify the occupational background of candidates in each mayoral election from TSE since 1996. There are 760 municipalities in the Legal Amazon region. The term of each mayor is four years, and they can run for reelection only once. We concentrate our investigation on three mayoral elections, 2004, 2008, and 2012 because the TSE changed the previous occupation classification between the elections of 2000 and 2004. Sixty-seven different occupations were identified (96.76% of the sample). We defined an agribusiness leader based on two job occupations: cattle breeders and agribusiness owners. Thus, our research compares the difference between agribusiness leaders, who serve as our treatment group, and leaders with other occupations, such as administrators, lawyers, merchants, business owners, physicians, politicians, professors, and public servants, among others, who serve as our control group (for more information, please see Online Appendix B).

Dependent variables: (i) Number of new firms (count). We used the Social Information Annual Report (*RAIS*) data to create the variable number of new formal firms set up. The number of new formal firms is an adequate proxy to capture the municipality's economic development, given its correlation with employment and taxes. The *RAIS* database contains information about firms and workers employed in each company in Brazil. Only formally constituted companies with a corporate tax identification number (*CNPJ*) are used. We considered a new firm in the database

when the company appeared for the first time in a specific year in the database.[7] We used only private organizations.

(ii) Deforestation (rate). Deforestation is an adequate proxy to capture the depletion of the environment in the Amazon region. Brazil uses remote sensing satellite data to monitor deforestation, which covers an area of 4.7 million square kilometers. The monitoring uses 20 to 30 meter resolution pictures which are captured and automatically processed via the National Institute for Spatial Research (*PRODES INPE*) system (Kintisch, 2007). Figure 2 shows the result of our dependent variables within the Legal Amazon in the municipalities participating in our study.

Insert Figure 2 about here

Mechanisms: Fiscal instruments. To understand the possible actions that the local mayor could have taken to produce economic and environmental results, we tested the impact of the agribusiness leader on some of the relevant variables found in the local government, i.e., variables that are part of the fiscal instruments at the municipal level: the municipal agricultural expenditure (this expenditure contains expenses with irrigation, plant and animal health protection, promotion of plant and animal production, and rural extension: expenditure to connect producers with innovations), municipal housing (this expenditure contains expenses with rural and urban housing services) and urbanism expenditure (this expenditure contains expenses with urban infra-structure: light, gas, telephone, and for the movement of production - new and better roads), municipal public

[7] For example, if the *CNPJ* (tax identification number) of a firm appeared for the first time in 2001, we considered it to be a new firm in that year. If a firm was added in 2001, it was considered as having existed in 2002, and so on. We used the year 1996 as our baseline and only classified new firms if they were not in the database between 1990 and 1995. Using the same strategy, a new firm in the following year (1997) is a firm that did not appear in 1996.

safety expenditure, municipalities without the collection of property tax (*IPTU*), municipalities with ISS incentive (the municipal service tax), and municipalities with a fee incentive.[8]

Method: Regression Discontinuity Design (RDD)

The main concern in performing general comparisons across municipalities managed by agribusiness vs. non-agribusiness leaders is that other observable and non-observable factors might be correlated simultaneously with the election of the leader and the results on the dependent variables. For example, we may conjecture that a municipality where the population engages in greater deforestation would be more likely to elect an agribusiness leader as mayor. However, note that it is not the leader's background driving greater deforestation, but a previous behavior of the local community.

Therefore, in order to pin down the causal effect of the leader's occupational background on the dependent variables, we need to introduce some randomness in the selection of these leaders to the mayor's seat. To do this, we use a Regression Discontinuity Design (RDD) comparing agribusiness vs. non-agribusiness mayors who were elected through a close margin of votes. This close electoral margin functions as a coin toss, which approximates the election result to a random event. All else equal, municipalities and mayors' characteristics (such as gender, education, and party filiation, among others) within this close margin of votes would be precisely the same. This guarantees that observable and non-observable characteristics are similar across the sample. The

[8] We use the agricultural expenditure because the agribusiness leader can use this type of spending to directly help firms from the agribusiness sector and indirectly firms that provide services to the agribusiness sector. The municipal housing and urbanism spending contains the municipal urban infrastructure, which is relevant for the development of new business. Municipal public safety expenditure can capture the worries from municipal leaders to preserve the law for local individuals or to guarantee public safety for new business (see the relationship between violence and business activity in Greenbaum and Tita, 2004). The set of three taxes (*IPTU, ISS*, and fee) are the instruments by which the local leader can provide incentives to new establishments (Hanson & Rohlin, 2011).

only difference is that in some locations, the agribusiness leader won by a fraction, while in others, they lost by a fraction (which introduces the quasi-randomness needed).

In other words, the regression discontinuity design (i.e., with the probability of victory of treatment group equal to one and zero otherwise; see Cattaneo et al., 2019; Flammer, 2015; Flammer & Bansal, 2017; Imbens & Lemieux, 2008; Lee & Lemieux, 2010)[9] allows us to estimate the causal effect of agribusiness elected mayors on our dependent variables (new firms, deforestation, and fiscal variables) within a municipality. Building on what others have done within such a context (Arvate et al., 2018; Arvate & Story, 2020), we exploit the as-if random assignment of agribusiness and non-agribusiness leaders to mayor positions, i.e., a quasi-experiment.

More technically, the key assumption of this sharp regression discontinuity design is that around the cutoff point, subjects (in this case, mayors of different professionals) are "as-if randomly" assigned to the treatment (with probability equal to one) and they do not differ on observable and unobservable characteristics (Arvate et al., 2018; Arvate & Story, 2020; Sieweke & Santoni, 2020). That is, we expect that a municipality in which an agribusiness candidate receives 50.1% of the votes against a non-agribusiness candidate does not systematically differ from a municipality where a non-agribusiness candidate was elected with, for example, 50.2% of the vote against an agribusiness candidate.

To implement this idea, we assume that the treatment variable $D_{i,t}$ is a dummy variable that equals one when an agribusiness leader candidate defeats a leader with other occupations in

[9] In the fuzzy regression design (FRD), the subjects can manipulate their positions around the cut-off point. Thus, the probability of an individual being in the treated group is lower than one. The FRD is more common for a public policy where the income or the population is a cut-off. See an application of FRD (population as cutoff) on Arvate and Souza (2022)

municipality i in year t and the control group ($D_{i,t} = 0$) is formed by the municipalities that elect a leader with other occupations in the same conditions established in the treatment municipality. The running variable (or assignment variable) is the margin of victory ($Margin_{i,t}$). Thus, the relationship between $D_{i,t}$ and $Margin_{i,t}$ can be written as follows:

$$D_{i,t} = \begin{cases} 1 \; if \; Margin_{i,t} > 0 \\ 0 \; otherwise \end{cases} \quad (1)$$

The impact of an agribusiness leader on $Y_{i,t+\xi}$ is defined by parameter β, which is a Local Average Treatment Effect (LATE) near the cutoff point. This effect can be written as follows:

$$\beta = \lim_{Margin \downarrow 0} E(Y_{it+\xi} | Margin_{it}) - \lim_{Margin \uparrow 0} E\left(Y_{it+\xi} \middle| Margin_{it}\right) \quad (2)$$

The implementation of the regression discontinuity methodology requires several different procedures. These tests allow us to confidently determine that the effects are caused by the agribusiness leader's background and not by any feature of the local environment, additional leader characteristics, or specificities of the electoral process.

The six main procedures are the following: 1) show that the same discontinuity observed in the estimates of dependent variables is not observed in these same variables in the past (this shows that the result in the dependent variables occurs after the quasi-experiment and is not predetermined); 2) demonstrate evidence of estimate with lower polynomials on estimates (Gelman and Imbens (2019). This suggests that elevated polynomials of assignment variable may contain a bias; RD estimate is essentially a difference between a weighted average of the dependent variable for treated observations – victory – on one side of the discontinuity and a weighted average of the same dependent variable for control observations – defeat – on the other side of the cutoff. Fitting a high order polynomial can mean this weighted average is driven by observations that are far away from the cutoff); 3) establish evidence of main results with different bandwidth

(bandwidth refers to how wide a range of the assignment variable around the cutoff is used to fit the local regression; the choice of bandwidth involves a tradeoff between bias and precision in the estimation: higher bandwidth gives more precision and increase the bias, lower bandwidth provokes the contrary effect); given that RD result is local (Local Average Treatment Effect), the same result with a lower and higher bandwidth permits to infer that there is the external validity on results; 4) show that the same discontinuity (in the cutoff point) observed in the estimates of dependent variables is visually observed in figures (inspecting the estimated version is a simple powerful way to visualize the identification strategy); 5) display that the same quasi-experiment does not generate discontinuity on observable characteristics of candidates and municipalities (covariates) (please see the results and non-discontinuity in figures in Online Appendix C); it guarantees that no predetermined characteristic is conditioning the electoral result (it helps in the defense of quasi-random experiment); 6) examine the density of observations of the assignment variable (i.e. the margin of victory around the cutoff) because a discontinuity may suggest that some candidates were able to manipulate their treatment status perfectly (McCrary's (2008) density test) (please see Online Appendix D).

We used only municipalities with fewer than 200,000 voters (the legislation does not permit a second round for these municipalities) to avoid strategic possibilities common in a second round in an election (Fujiwara, 2011).[10] Also, we used the estimator suggested by Calonico et al. (2014) to estimate β. This shows that the nonparametric estimation of (equation 2) by local linear regression typically leads to too "large" bandwidth choices, meaning there will be a large asymptotic bias term.[11] These authors propose a way to correct this bias, which we used in this

[10] The municipalities of the Amazon region are diverse/disperse in political characteristics as our initial sample shows (see the observable characteristics far from the cut-off in Table 1 and dispersion of municipalities in Figure 2). Thus, municipalities from different areas following the previous procedures guarantee that our results are representative for all the region, and they have external validity.

[11] A triangular kernel function, in which the weight of each observation decays at a distance from the cutoff.

paper (a confidence interval constructed using a bias-corrected RD estimator together with a novel standard error estimator). Finally, our standard errors of estimates are robust and clustered at the municipal level.

RESULTS

Descriptive Statistics

Table 1 depicts our descriptive statistics. We present statistics (number of observations, average, and standard deviation (S.D.) in the six columns) for the municipalities of both municipal leaders (mayors): agribusiness leaders and leaders with other occupations. [12]

Insert Table 1 about here

Among the leader's characteristics, we observe statistical differences in gender, education level, and political affiliation. On the other hand, they are statistically similar to the other mayors with different occupations when it comes to high school and the affiliation of parties such as the DEM (right-wing) and MDB parties (center).

Among the municipalities in which the elected leaders have agribusiness as their occupation and municipalities in which the elected leaders have other occupations, the great majority of our variables indicate no statistical differences (see the significance between the variable in Column 2, average, Table 1): the number of new companies, deforestation, total herd, livestock, total planted area, soybean planted, exports, agriculture expenditure, public safety expenditure, housing and urbanism expenditure, ISS incentive, fee incentive, and 2004, 2008, and 2012 elections. Only one variable was statistically different, namely municipalities without IPTU

[12] The correlation matrix can be seen in Online Appendix M

(property tax) collection. We observe that municipalities with agribusiness leaders have more IPTU exemptions than municipalities with leaders with other occupations.

Main Effects of Agribusiness Leaders on Economic and Environmental Performance

We present the difference in the results between agribusiness leaders and leaders with other occupations in Table 2.

Insert Table 2 and Figure 3 about here

Table 2 contains two groups of nonparametric RD results: the first, on the number of new firms; the second, on deforestation. In the first group, the previous electoral result (2001-2004) is in Column 1 (p = 0.214; evidence that the main result is not previous of our quasi-experiment; see the list of RD procedures above – item 1), and posterior electoral results (three terms: 2005-2008, 2009-2012, 2013-2016) are between columns 2 and 6. Given the significance of the results on the dependent variable in this first group (Column 2; p = 0.055), we present this evidence with robustness (columns 3-6).

Column 2 shows that municipalities with agribusiness leaders see the creation of 10.71 more new firms per term year (p = 0.055) when compared with municipalities with leaders of other occupations (second-degree polynomial – see the list of RD procedures above – item 2). This is confirmed with a third-degree polynomial (Column 3: 13.33 new firms, p = 0.037) and with different fixed bandwidths (second-degree polynomial again, Columns 4: bandwidth equal to 0.10; Column 5: bandwidth equal to 0.20; Column 6: bandwidth equal to 0.30 – see the list of RD procedures – item 3). In the second group, the previous electoral result (2001-2004) is in Column 7 (p = 0.310), and the posterior electoral results (three terms: 2005-2008, 2009-2012, 2013-2016)

are in Column 8 (second-degree polynomial, $p = 0.448$) and Column 9 (third-degree polynomial, $p = 0.665$) show non-significant results on deforestation (acres).

The general interpretation of results (from two dependent variables) highlights that local agribusiness leaders positively affect economic development while not producing a different result in the local environment when compared to their non-agribusiness counterparts. The results suggest that local agribusiness leaders see the creation of significantly more companies while not necessarily increasing deforestation more than leaders with other occupations.

To estimate the magnitude of the economic impact promoted by the election of an agribusiness leader, we highlight the following information. The mean population of the municipalities where agribusiness mayors got elected is 15,712 inhabitants. The economically active population included about 65% of the total population, and the unemployment rate was around 7% for the period.[13] It is also crucial to notice that almost 60% of the economically active population was working in informal positions (Alfenas et al., 2020). Given the context cited previously, we could expect that a typical municipality would have around 700 unemployed individuals. Considering the generation of new jobs prompted by the election of agribusiness mayors, we verify that each company in our sample typically has 4.293 formal employees. Therefore, the creation of 10.71 new companies could potentially generate over 45 formal positions per municipality each year, which corresponds to 6.4% of the unemployed individuals in the municipality.

In terms of potential taxes, and the circulation of money in the municipality, we could perform a conservative estimation of the impact by assuming that all these jobs paid the average

[13] Imazon. Available at: < https://imazon.org.br/o-avanco-da-fronteira-na-amazonia-do-boom-ao-colapso/ >. Accessed on May 23rd, 2023.

minimum wage in Brazil during this period (from 2004 to 2012), which equals R$408.70 (~U$ 200).[14] If so, we can conclude that an additional total wage increment of R$ 18,392 (~U$ 9,003) per month per municipality has been generated in the agribusiness vs. non-agribusiness municipalities at the end of the agribusiness mayor's mandate. Notice, however, that this value does not include income taxes and the multiplier effects that the employee's consumption may have in these locations.

Below, we further evaluate the consistency of our results using multiple approaches. Firstly, Figure 3 reports two results: the difference between local agribusiness leaders and local leaders with other occupations on both the number of new firms (Panel A) and deforestation (Panel B). Panel A visually confirms the discontinuity found in the number of new firms estimates when the margin is close to zero. Looking at the figure on the left side next to the cutoff, we see the average number of companies per term created by non-agribusiness leaders: around 5. On the other hand, on the right side next to the cutoff, we have the average number of companies per term created by agribusiness leaders: around 16 (the difference between them in the estimate is 10.71) In Panel B it can also be seen that there is no discontinuity for deforestation, confirming the estimates presented. Figures use evenly-spaced bins (i.e., bins that have equal lengths). We build the same figures with bins containing the same number of observations and different sizes (quantile spaced). Except for the results of deforestation (for which we consider only the figures evenly-spaced given that we do not observe significant discontinuity on estimates), all results are similar.[15]

Further analysis does not show any influence of covariates on the electoral results (i.e., they are balanced: leaders and municipal characteristics are statistically similar; please see again

[14] Considering the US-BRL exchange rate on Dec. 31st, 2012, equals 2,0429.
[15] Figures have been omitted due to space limitations but can be made available by the authors upon request.

the Online Appendix C). And we also showed that there is no electoral manipulation (please see again the Online Appendix D).

Mechanisms: Fiscal Incentives Used by Agribusiness Leaders

To understand how agribusiness leaders manage to increase the number of companies without harming the forest, it is crucial to explore the mechanisms supporting these results. The first step is to identify whether fiscal instruments are used differently by local agribusiness leaders in their municipalities when compared with non-agribusiness leaders. We present the results below.

Insert Table 3 about here

We used three expenditures (agricultural expenditure, public safety expenditure, and housing urbanism expenditure) and three tax instruments (municipalities without IPTU collection, with ISS incentive, and with Fee incentive).

Two types of expenditures are used more in municipalities governed by agribusiness leaders when compared with municipalities with non-agribusiness leaders, namely: agricultural expenditures, and housing and urbanism expenditures. For example, a mayor may use direct municipal expenditure to acquire and distribute seeds to local producers to stimulate their agricultural activity (for other examples of investments made by agribusiness mayors, please see Online Appendix E). Interestingly, the fiscal instruments are significant only when the municipalities have soybeans planted (see Column 1: $p = 0.020$; Column 3: $p = 0.000$).

Then we investigate which of those fiscal instruments are important for municipalities with livestock above the median and municipalities with soybean planted areas.[16] (please see Online Appendix F and G for different fiscal instruments tested for municipalities with soybean planted and municipalities with livestock above the national median).

The results presented in Tables 4A and 4B show that the same fiscal instruments are significant only for municipalities with soybeans planted: with agricultural expenditure ($p = 0.001$) and with housing and urbanism expenditure ($p = 0.001$).

These results make qualitative sense since agricultural areas planted with soybeans are more economically dynamic than cattle ranching areas, which are usually less labor-intensive and are used as patrimony.

Insert Tables 4A and 4B and Figure 4 about here

The structure of the main results is similar when estimated using different polynomials and different bandwidths. Figure 4 (Panel A and B) shows the same discontinuity observed when the margin is close to zero as those observed in our main results (please see Online Appendix H about estimate (new firms and deforestation), balance of covariates, and non-electoral manipulation results when we have municipalities with soy planted and using different instruments of fiscal: agricultural expenditure and housing and urban expenditure).

[16] Before exploring these two instruments in the results, considering that the occupation of an agribusiness leader is linked to agriculture activity, we decided to explore the importance of different heterogeneities of sample on the creation of the number of firms previously. We observe municipalities with different total planted areas (municipalities above and below the median on the Legal Amazon region), and municipalities without or with soybean planted (soybean is the planted area in expansion in the region, and it is mostly exported; see Strand et al. (2018).
The investigation on the heterogeneities of the sample reveals that the results from new firms come from municipalities with a total herd above median compared to other municipalities on Legal Amazon ($p = 0.050$), basically concentrated in municipalities with livestock above median ($p = 0.030$) and municipalities with soybean planted ($p = 0.0001$). Please see Online Appendix F with these results; evidence of non-electoral manipulation and balancing of covariates for each one of heterogeneities of sample.

In sum, we found that the main mechanism by which agribusiness leaders promote economic growth in the municipalities they lead is through superior expenditure on agriculture, and infrastructure and urbanism. Expenses related to agriculture include the establishment of local community markets, the procurement of agricultural equipment and inputs, among others. Additionally, investment in road creation, bridge construction, public lighting provision, and sewage treatment exemplifies infrastructure and urbanism expenditures. Our results suggest that such spending helps to dynamize local economies and therefore increases the number of companies in operation.

Heterogeneities: Types of Firms Created with Agribusiness Leader Support

To identify the type of firm created, we classified companies into five different categories according to their industries. The classification followed a Brazilian system entitled CNAE, which is equivalent to the North American Industry Classification System (NAICS). The categories analyzed were: (1) Agribusiness; (2) Coal, oil, and mineral extraction; (3) Manufacturing; (4) Manufacturing (using inputs from categories 1 and 2); and (5) Services.

We ran regressions using the mean number of firms created belonging to each category as our dependent variables and the agribusiness leader as our independent variable, following the same procedure adopted previously. In line with our previous results, we once again limit our sample to municipalities that had soybean planted areas and that used agricultural or housing and urbanism direct expenditures. We present the results in Tables 5A and 5B.

Insert Tables 5A and 5B about here

The result of the regressions using the mean number of new businesses of all categories (Column 1), and specific results for each category (Columns 2 to 6) suggest that the election of

agribusiness-related mayors promotes an increase in the number of new firms belonging to all sectors, excluding those related to the exploration of natural resources.

However, the Services sector is the one that presents the highest number of firms created. These do not necessarily promote higher deforestation due to their core activities, and their creation may result from the development of a local economic environment that increases the demand for multiple supporting activities. This is also compatible with the investment in local infrastructure observed in our data, as this economic development may stimulate investment to bring efficiency to the entire environment.

Once again, these results make qualitative sense since greater investment in agriculture, infrastructure, and urbanism will increase the number of interactions among people living in the same community and will increase the need for further services to be provided within this more dense and dynamic community.

ROBUSTNESS CHECKS

To be sure that the results observed were indeed driven by the quasi-random election of an agribusiness leader, we conducted a set of robustness checks on our main results.

Other Occupations as Leaders

One concern was if, by pooling together all other occupations that were non-agribusiness related, we were affecting the results. To test for this, we performed analyses isolating other occupations such as administrators, lawyers, merchants, business owners, physicians, politicians (previous mayors or councilors), professors, and public servants. The results for these other occupations do not produce the same as for agribusiness leaders on dependent variables (please see Online Appendix I).

Changes in the Productivity of Agribusinesses: Soybean and Corn Planted Area

An alternative explanation of why the agribusiness leaders would not affect deforestation, unlike their non-agribusiness counterparts, would be if they were focusing on increasing the productivity of the already deforested areas. Thus, we tested if there are differences in productivity between municipalities governed by agribusiness leaders and other leaders. Using the same methodology, we specifically investigated if there are differences between the total planted area of soybean and the planted area of corn (notice that corn is found in a lower number of municipalities than soybean). Note that an increase in the agricultural area would represent an increase in productivity, given the low productivity level of cattle ranching in the Amazon (Rajão et al., 2020). We did not observe a significant difference between the two types of municipalities (please see Online Appendix J).

ONGs and Environmentally Conscientious Firms Influence in this Process

Finally, in order to ensure the robustness of our findings, it is important to investigate if specific private projects are influencing our results. Environmentally conscientious firms can act on the Amazon region both through their direct operation or indirectly by financing or supporting local grassroots organizations and NGOs. The results show that the exclusion or presence of NGOs does not change the main result for the creation of new companies and deforestation. Finally, albeit with a lower significance level (p = 0.057), the presence of an environmentally conscientious company in different municipalities determines a reduction in the creation of new firms while not affecting the results of deforestation (please see Online Appendix K). In general terms, the results confirm that the large environmentally conscientious firms (directly or indirectly) did not affect the effect of local agribusiness leaders, as shown by our main results.

DISCUSSION AND CONCLUSION

Are agribusiness leaders “heroes” or “villains” for the Amazon rainforest? This study has shown that these leaders might be surprisingly more the former rather than the latter. Through a Regression Discontinuity Design (RDD), this study has determined that agribusiness leaders contributed to a significant increase in the number of companies set up in Amazonian municipalities while not increasing deforestation rates more than their non-agribusiness counterparts. Progressive fiscal policies, such as increased agriculture expenditures and infrastructure development in housing and urbanism, were the main drivers for positive economic growth. In managing fiscal instruments adequately, marginally elected agribusiness leaders promote a more dynamic economy without necessarily depleting the rainforest of the municipalities they run more than non-agribusiness leaders.

Implications for Theory

The findings in this study contribute to the management literature in three main ways. First, the study addresses calls for more research about grand social challenges related to the U.N. Sustainable Development Goals (George et al., 2016, 2023). We respond to this call by looking at the Amazon rainforest, an area of vital importance to the world, given its effects on climate change. By testing the causality between leader’s occupational background and sustainable development variables, mainly related to economics (new business creation) and ecology (deforestation) (Antonakis, 2017; Martin et al., 2021; Sieweke & Santoni, 2020), the study reinforces the importance of management to generate superior outcomes in both domains (Bansal & DesJardine, 2014; Delmas & Toffel, 2008; Ferraro et al., 2015; George et al., 2012, 2016). The study suggests that economic development and environmental protection are not necessarily incongruent. Furthermore, this research contributes to the literature on sustainability by looking at satellite data on deforestation, which specialists consider ideal when analyzing forest preservation (Kintisch,

2007; Ostrom & Nagendra, 2006). By understanding what is happening in the Amazonian context, we also contribute to public policy related to environmental protection, which is an essential area for scholars to engage with (Antonakis, 2017).

Second, the study also contributes to literature on leadership. While most of the research on environmental sustainability focuses on its economic or financial impacts, few studies look at the effects of a leader's actions on ecological outcomes. Previous research has found four primary drivers of environmental sustainability: values, economic opportunities, legislation, and stakeholder pressures (Bansal & Roth, 2000). Bansal and Roth (2000) found that ecological responsibility was often attributed to a single person who championed their responses, consistent with the findings of Lawrence and Morell (1995). Leaders' values are individual and have been shown to influence decisions that impact the business environment (Judge & Bretz, 1992). Values help leaders understand what is worth pursuing and what is not (Dutton, 1997). Whether a leader has pro-environmental values could influence the type of communication, actions, and policies they create or reinforce. However, environmental sustainability impacts happen gradually and are very complex. If local leaders, such as mayors, are in power for only two terms and considering that in their first term, their main goal is to get re-elected, they most likely would focus on communicating or acting in more visible ways, such as focusing on economic development as a sign of effectiveness (Arvate & Story, 2020). This is especially the case for leaders who come from an agribusiness background, as they are less likely to be concerned about environmental responsibility (Rosano-Peña et al., 2014). However, as we have seen, not only were values relevant, but economic opportunities and stakeholder pressures could have had an impact on our results. In fact, we can argue that based on our research, both economic opportunities and

stakeholder pressures (Bansal & Roth, 2000) were more effective in driving environmental sustainability than a leader's values.

Finally, this study contributes to the literature on New Institutional Economics (Alston et al., 1996; North, 1990; Williamson, 2000), particularly reinforcing the importance of macro institutional policies and regulations that design incentives for ecologically friendly behavior. The analysis period of this study (from 2004 to 2016) is precisely during the Brazilian Federal administrations that most intensively invested in reducing deforestation in the Amazon region (see Figure 1). The macro institutional apparatus developed to restrain deforestation was incorporated into local leaders' rational calculation and decision-making, whether they had an agribusiness background or not. Thus, the macro institutional drivers and incentives contributed to reconciling ecological and economic objectives, fostering a positive response from local leaders regarding forest preservation across groups with heterogeneous backgrounds. However, when changes in the "rules of the game" (North, 1990, 1991) occur, leaders' expectations and behavior may also change. During more recent administrations (from 2017 to 2022), the Amazon forest was once again pictured as an impediment to the country's economic development (Mendes et al., 1989; Symonds, 2019). The macro institutional environment revised policies, regulations, and incentives, which might revive a conflictive view of ecological and economic objectives. Altogether, this study reinforces the argument that well-design policies and regulations can promote positive behavior, which can contribute to overcoming some "Grand Challenges" (George et al., 2016, 2023) related to the economic development of disenfranchised communities and attenuation of climate change.

Implications for Practice

The study results are of interest to public policy. Our quasi-experimental results might help to justify public policies that contribute to dynamizing local economies through public expenditures, which will foster the creation of new businesses and incentivize local entrepreneurship without necessarily further damaging the natural environment. Moreover, since this study considers a period in which deforestation was low, it reinforces the importance of institutional constraints towards behaviors that would be detrimental to environmental preservation. In this sense, our results show that if the institutional environment gives adequate incentives, individuals, such as local leaders, will pursue strategies to reconcile economic and ecological objectives.

Limitations

There are two main limitations we believe are important to be pointed out. First, we have information about the patrimony of candidates for 2004, 2008, and 2012. We tested the influence of two specific types of patrimony in the results: ownership of a cattle ranch and ownership of a property registered in the municipality. Given the low number of observations for cases in which the margin of victory was close to zero, we did not get an estimate of the previous results with these heterogeneities. Second, despite having external validity for the Amazonian context – due to the presence of municipalities from different Amazon locations – the findings are specific to the Amazon region context and should be cautiously generalized to others.

Despite these limitations, the findings might inform policy-makers about the importance of a robust institutional environment that supports ecologic preservation. Furthermore, the findings provide guidance to local leaders regarding the efficacy of proficiently employing fiscal policy instruments as a means to attain enhanced levels of economic progress that are not contingent upon environmental degradation.

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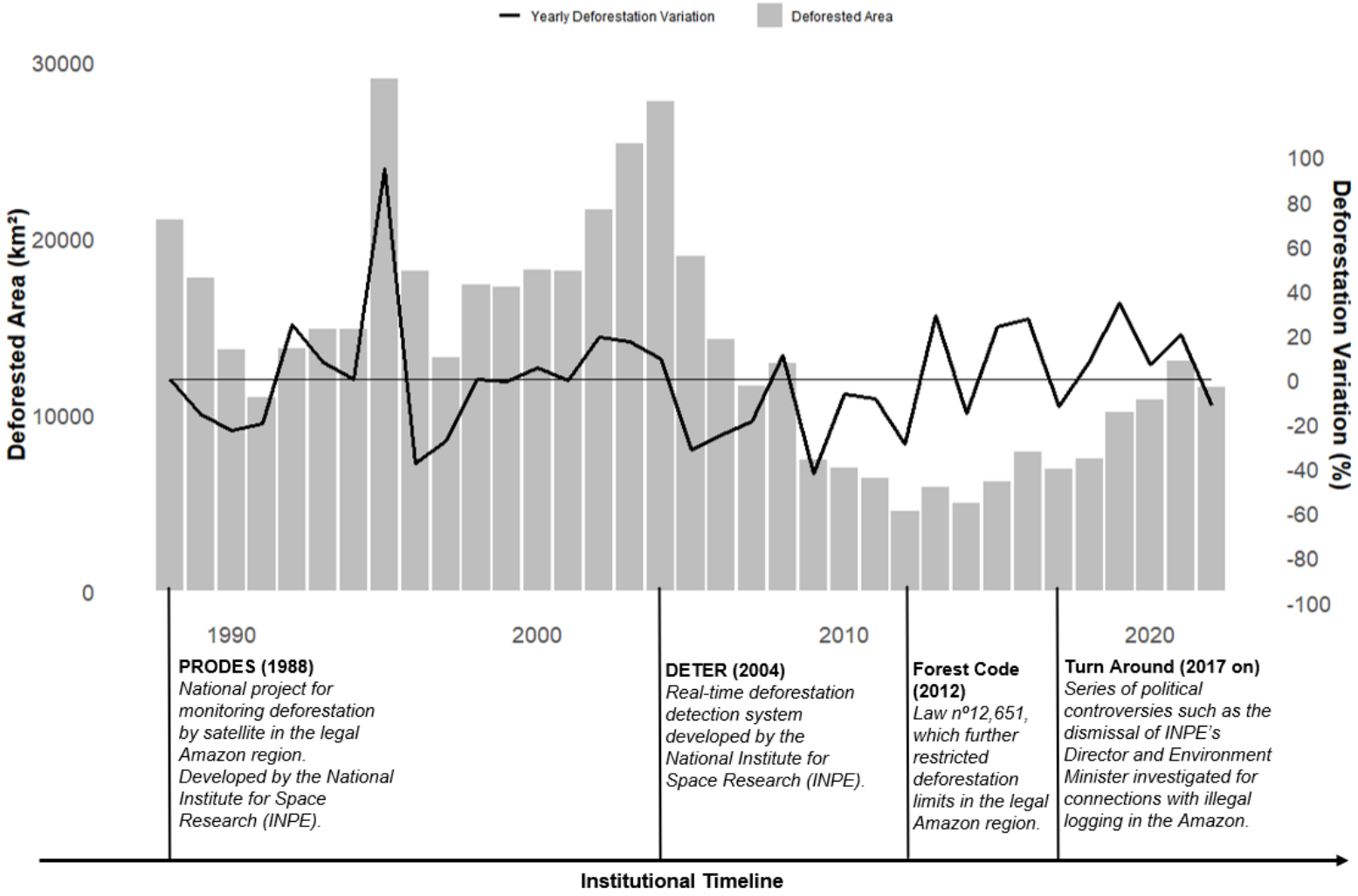
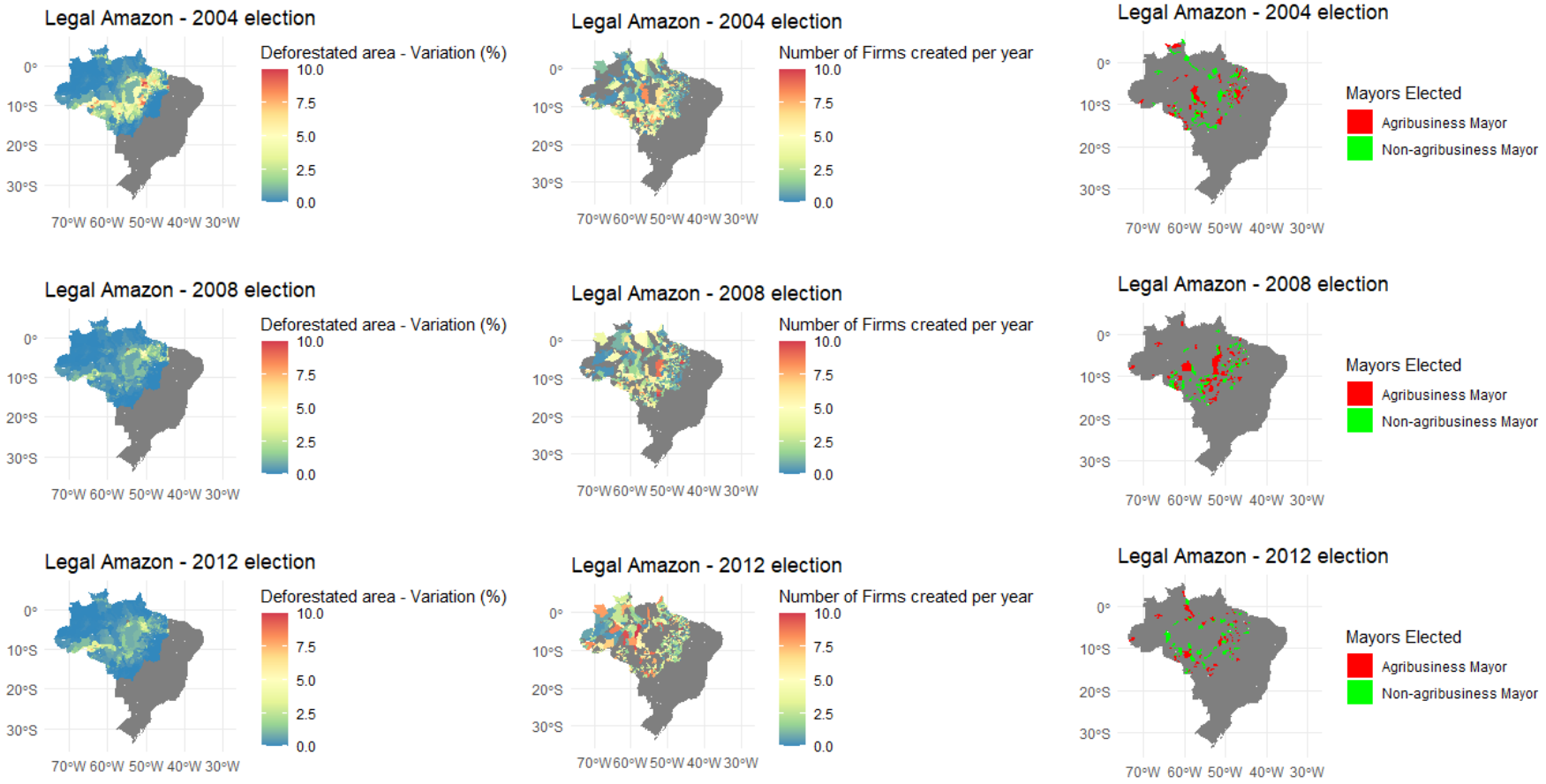
FIGURES

Figure 1: Total Deforested Area (km^2), Deforestation Rate (in %) and Intertemporal Institutional Changes in Brazilian Amazon



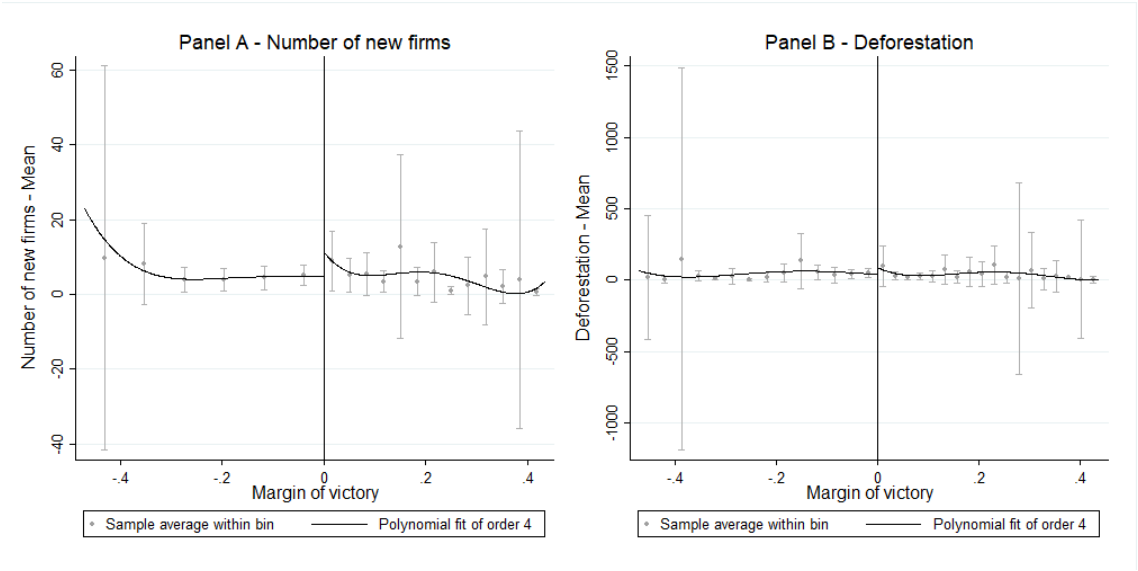
Note: Data from INPE and institutional description from diverse sources.

Figure 2: Deforestation (%), New Firms Created (count), and Municipalities by Mayor Types – Amazon Region in Brazil



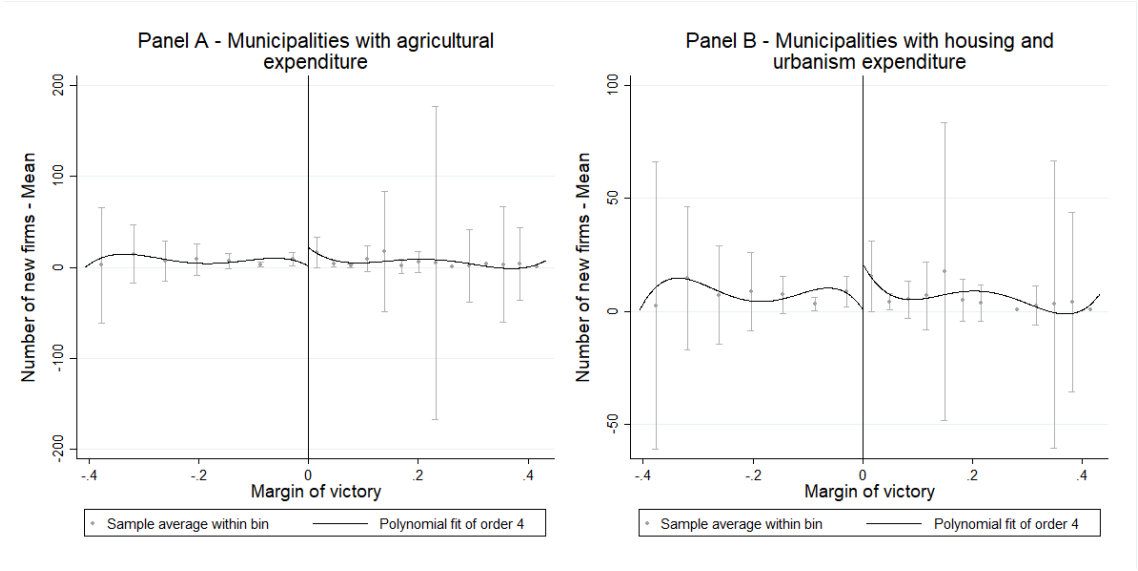
Note: Deforestation rate is measured in (%), number of firms created (count), and mayor types elected.
Maps from the third column include only municipalities where the agribusiness candidate is running with a non-agribusiness candidate being in first or second place.
(Three terms: 2005-2008, 2009-2012, and 2013-2016).

Figure 3: Local Leader Effects on Economic and Ecological Outcomes



Note: Panel A shows the number of new firms, Panel B shows the total deforestation. Each dot represents the mean within each bin and the lines represent the CI within each bin at 99% (2.58 +/-s.e.). The nonparametric estimate is calculated using these points.

Figure 4: Fiscal Policies Implemented by Local Leaders



Note: Panel A shows the number of new firms or municipalities with municipal agricultural expenditure, Panel B shows the number of new firms for municipalities with local urbanism expenditure. Only soybean production municipalities included. Each dot represents the mean within each bin and the lines represent the CI within each bin at 99% (2.58 +/-s.e.). The nonparametric estimate is calculated using these points.

TABLES

Table 1: Descriptive statistics

	Agribusiness leaders (mayors)			Other occupation leaders (mayors)		
	Obs.	Average	SD	Obs.	Average	SD
Female mayor	197	0.035**	0.185	215	0.111	0.315
Full elementary school	197	0.411***	0.493	215	0.186	0.39
High School	197	0.416	0.494	215	0.376	0.485
Superior education	197	0.116***	0.321	215	0.418	0.494
PSDB (Brazilian Social Democracy Party)	197	0.127**	0.333	215	0.065	0.247
DEM (Liberal Party)	197	0.060	0.24	215	0.055	0.23
MDB (Brazilian Democratic Movement Party)	197	0.147	0.355	215	0.153	0.361
Employee	147	4.293	6.52	169	4.646	9.475
Unemployment insurance	179	0.726	7.791	195	0.502	2.766
Work card issued	179	0.173	1.919	195	0.235	1.186
Vaccines	190	7576.11	8817.42	202	6874.48	7754.42
Coffee dependency	190	0.041	0.12	202	0.049	0.126
Environmental zoning legislation - Law 121	197	0.081	0.27	215	0.111	0.315
Environmental impact analysis legislation – Law 211	197	0.111	0.315	215	0.125	0.332
Number of new firms	170	5.49	11.77	182	5.01	8.183
Deforestation	197	42.11	101.34	215	48.95	118.44
Total Herd	197	210248.2	380425.7	215	242369.5	883136
Livestock	197	119302.5	175389.1	215	122066.2	132592.3
Total planted area	196	19271.37	65274.49	215	24978.88	84176.01
Soy planted	197	0.63	0.482	215	0.637	0.481
Ln agriculture expenditure	190	11.97	1.34	208	12.11	1.47
Ln public safety expenditure	74	8.78	2.17	84	9.02	2.24
Ln housing and urbanism expenditure	194	13.62	1.35	212	13.71	1.21
Without IPTU's collection	197	0.126**	0.333	215	0.046	0.211
ISS incentive	197	0.086	0.281	215	0.116	0.321
Fee incentive	197	0.106	0.309	215	0.1209	0.326
NPOEAP	197	0.030	0.172	215	0.037	0.189
Environmental conscientious firm	197	0.040	0.172	215	0.046	0.211
The 2004 election	197	0.406	0.492	215	0.339	0.474
The 2008 election	197	0.324	0.469	215	0.4	0.491
The 2012 election	197	0.269	0.444	215	0.26	0.439

Notes: * Significance at the 10% level, ** at 5% level, and *** at 1% level; Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011).

Table 2: Main effects of agribusiness leaders on local development (number of new firms and deforestation)

	Nonparametric RD								
	Dependent variables:								
	Number of new firms						**Deforestation**		
	Previous to 2004	Posterior to 2004					Previous to 2004	Posterior to 2004	
	Second-degree polynomial		Third-degree polynomial	Second-degree polynomial			Second-degree polynomial	Second-degree polynomial	Third-degree polynomial
				Different fixed bandwidths					
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Agribusiness leader	**13.48**	**10.71***	**13.33****	**17.70****	**12.63****	**9.072***	**170.3**	**32.50**	**18.05**
	(10.85)	**(5.589)**	**(6.398)**	**(7.642)**	**(6.092)**	**(4.989)**	**(167.7)**	**(42.84)**	**(41.72)**
P-value	***0.214***	***0.055***	***0.037***	***0.021***	***0.038***	***0.069***	***0.310***	***0.448***	***0.665***
Number of observations	100	352	352	352	352	352	153	412	412
Effective number of observations	81	227	272	158	258	306	74	331	313
Considered bandwidth	0.212	0.164	0.222	0.100	0.200	0.300	0.109	0.241	0.215
	Number of clusters								
Left side	51	128	138	71	118	139	47	173	167
Right side	39	131	135	81	118	136	55	158	155

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016. 5) The number of observations for the variable "Number of new firms" is lower than the variable "Deforestation" because we have fewer municipalities with the presence of new formal firms.

Table 3: Mechanisms: Fiscal instruments used by agribusiness leaders in municipalities with soy planted

	Nonparametric RD					
	Posterior to 2004. Municipalities with soy planted.					
	Second-degree polynomial					
	Dependent variables:					
	Ln Agricultural expenditure	**Ln Public safety expenditure**	**Ln Housing and Urbanism expenditure**	**Without IPTU collection**	**ISS incentive**	**Fee incentive**
	[1]	[2]	[3]	[4]	[5]	[6]
Agribusiness leader	**2.6421****	**1.524**	**2.817*****	**-0.0418**	**-0.160**	**0.0385**
	(1.132)	**(1.297)**	**(0.735)**	**(0.0742)**	**(0.233)**	**(0.0819)**
P-value	***0.020***	***0.240***	***0.000***	***0.573***	***0.491***	***0.638***
Number of observations	146	62	149	150	150	150
Effective number of observations	85	41	76	85	96	85
Considered bandwidth	0.135	0.147	0.110	0.128	0.158	0.128
	Number of clusters					
Left side	51	25	51	58	54	56
Right side	47	22	50	57	53	56

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

Table 4A: Mechanisms: Influence of fiscal instruments used by agribusiness leaders Municipalities with soy planted

	Nonparametric RD				
	Dependent variables: Number of new firms				
	Municipalities with agricultural expenditure				
	Posterior to 2004				
	Second-degree polynomial	Third-degree polynomial	Second-degree Polynomial		
			Different fixed bandwidths		
	[1]	[2]	[3]	[4]	[5]
Agribusiness leader	**35.40*** **	**37.21*** **	**34.44*** **	**32.62*** **	**23.64*** **
	(10.84)	**(11.76)**	**(11.83)**	**(9.848)**	**(8.283)**
P-value	0.001	0.002	0.004	0.001	0.004
Number of observations	132	132	132	132	132
Effective number of observations	66	83	61	97	114
Considered bandwidth	0.112	0.158	0.10	0.20	0.30
	Number of clusters				
Right side	42	49	30	48	58
Left side	39	43	30	43	49

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

Table 4B: Mechanisms: Influence of fiscal instruments used by agribusiness leaders Municipalities with soy planted

	Nonparametric RD				
	Dependent variables: Number of new firms				
	Municipalities with housing and urbanism expenditure				
	Posterior to 2004				
	Second-degree polynomial	Third-degree polynomial	Second-degree Polynomial		
			Different fixed bandwidths		
	[6]	[7]	[8]	[9]	[10]
Agribusiness leader	**36.28*** **	**38.04*** **	**35.01*** **	**32.62*** **	**23.49*** **
	(10.92)	**(11.83)**	**(11.85)**	**(9.805)**	**(8.195)**
P-value	0.001	0.001	0.003	0.001	0.004
Number of observations	135	135	135	135	135
Effective number of observations	67	85	64	100	117
Considered bandwidth	0.109	0.157	0.10	0.20	0.30
	Number of clusters				
Right side	42	49	30	48	58
Left side	42	46	33	46	52

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

Table 5A: Types of Firms set up in Municipalities with soybean planted and agricultural expenditure

	Nonparametric RD					
	Dependent variables: Number of new firms					
	Municipalities with agricultural expenditure					
	Posterior to 2004					
	Second-degree polynomial					
	Firms' Categories					
	General	Agribusiness	Natural Resources Extraction	Manufacturing	Manufacturing II	Services
Agribusiness leader	**35.40*** **	**3.01*** **	**0.00**	**2.22** **	**0.86*** **	**29.16*** **
	(10.84)	**(1.04)**	**(0.01)**	**(0.94)**	**(0.23)**	**(9.00)**
P-value	0.001	0.004	0.660	0.018	0.000	0.001
Number of observations	132	132	132	132	132	132
Effective number of observations	66	65	91	70	67	66
Considered bandwidth	0.112	0.110	0.175	0.120	0.114	0.113
	Number of clusters					
Right side	42	45	58	40	45	42
Left side	39	39	50	39	39	39

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

Table 5B: Types of Firms created in Municipalities with soy planted and housing and urbanism expenditure

	Nonparametric RD					
	Dependent variables: Number of new firms					
	Municipalities with housing and urbanism expenditure					
	Posterior to 2004					
	Second-degree polynomial					
	Firms' Categories					
	General	Agribusiness	Natural Resources Extraction	Manufacturing	Manufacturing II	Services
Agribusiness leader	**36.28*** **	**3.08*** **	**0.00**	**2.25** **	**0.87*** **	**29.89*** **
	(10.92)	**(1.04)**	**(0.01)**	**(0.94)**	**(0.23)**	**(9.08)**
P-value	0.001	0.003	0.65	0.016	0.000	0.001
Number of observations	135	135	135	135	135	135
Effective number of observations	67	67	94	72	69	68
Considered bandwidth	0.109	0.108	0.176	0.118	0.113	0.110
	Number of clusters					
Right side	42	45	59	41	45	42
Left side	42	42	53	42	42	42

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

APPENDIX

ONLINE APPENDIX

HEROES OR VILLAINS? AGRIBUSINESS LEADERS IN THE AMAZON REGION

This is the online appendix for "**HEROES OR VILLAINS? AGRIBUSINESS LEADERS IN THE AMAZON REGION"** It contains additional material used in the paper that are necessary to fully document the research contained in the paper and to facilitate the readers' ability to understand the work.

ONLINE APPENDIX A – LABEL, CONSTRUCTION, AND SOURCE OF VARIABLES

Table A1 - Panel A: Label, construction, and source of variables

Label		Construction	Source
Gender of mayors	**Female mayor**	Dummy variable with value equal 1 if the elected mayor is a woman and zero otherwise	Superior Electoral Court (*TSE*); election year for mayors (2004, 2008, and 2012)
Education of mayors	**Full elementary school**	Dummy variables with value equal 1 if the information follows the schooling established and zero otherwise	
	High School		
	Superior education		
Parties of mayors	**PSDB (Brazilian Social Democracy Party)**	Dummy variables with values equal to 1 and zero otherwise. We included one center-left-wing party (PSDB), one party in the center (MDB), and one right-wing party (DEM) using as the source of classification of Latin American political parties that was established by Coopedge (1997)	
	DEM (Liberal Party)		
	MDB (Brazilian Democratic Movement Party)		
Municipal Characteristics	**Employee**	The municipal number of employees hired by each formal firm. We extracted the number of employees of all private organizations in each year in the municipality. After this, we consider the average on term before the election year.	*RAIS* – Annual Social Information on workers in firms in the formal sector – produced by the Ministry of Employment and Labor. We use information data from 1990 and 2016. The information is provided annually by firms (information centralized in December)
	Unemployment insurance	The number of unemployed workers who are receiving unemployment insurance in the municipality. We consider the average on term before the election year.	Ministry of Labor and Employment
	Work card issued	The number of work card issued (like the card from Social Security) in the municipality. We consider the average on term before the election year.	
	Vaccines	The number of (public) vaccines applied in the municipal population (eight types of vaccine per individual). We consider the average on term before the election year.	Ministry of Health (*DATASUS*)
	Coffee dependency	% of coffee plantation on the total municipal agricultural plantation. We consider the average on term before the election year.	IBGE´s (*Instituto Brasileiro de Geografia e Estatística*) Automatic Recovery System (*SIDRA*)
	Environmental zoning legislation (*ZEMA –Zonas Especiais de Proteção Ambiental*)	Existence of legislation concerning environmental or ecological-economic zoning. Dummy variable equal to 1 when there is such legislation in the municipality (created prior to the mayor's term) and equal to zero otherwise.	Survey of Basic Municipal Information - *MUNIC (IBGE): MUNIC,* 2018
	Environmental impact analysis legislation	Existence of legislation concerning preliminary environmental impact analysis. Dummy variable equal to 1 when there is such legislation in the municipality (created prior to the mayor's term) and equal to zero otherwise.	

Table A1 – Panel B: Label, construction, and source of variables

Label		Construction	Source
Municipal Characteristics	**Business creation**	The number of firms created in the municipality. We calculated the average of the number of firms created during the four years in the term (for instance, 2001/2004, 2005/2008, 2009/2012, 2013/2016).	*RAIS* – Annual Social Information on workers in firms in the formal sector – produced by the Ministry of Employment and Labor. We use information data from 1990 and 2016. The information is provided annually by firms (information centralized in December)
	Business creation – service sector	The number of firms created in the municipality belonging to the following sector of activity: **services and retail.** We used the National Classification of Economic Activities (*CNAE*) to classify each firm.	
	Deforestation	The accumulated deforestation was calculated as the sum of the annual deforestation (acres) during the four years in the term (for instance, 2001/2004, 2005/2008, 2009/2012, 2013/2016)	The Monitoring the Brazilian Amazon Gross Deforestation (*PRODES, from the National Institute for Space Research, INPE*)
	Total Herd	The total number of animals created in the municipality (e.g. swine, cattle, chickens, and others). We used the annual sum of the number of heads existent in each municipality for each term (2005/2008,2009/2012, 2013/2016)	IBGE´s - (*Instituto Brasileiro de Geografia e Estatística*) Automatic Recovery System (*SIDRA*)
	Livestock	The total number of livestock created in the municipality. We used the annual sum of the number of heads existent in each municipality for each term (2005/2008,2009/2012, 2013/2016)	IBGE´s - (*Instituto Brasileiro de Geografia e Estatística*) Automatic Recovery System (*SIDRA*) Livestock Production Report – Table 3939
	Total Planted	Area planted or destined for harvest. We used the annual sum in the municipality for each term (2005/2008,2009/2012, 2013/2016)	IBGE´s - (*Instituto Brasileiro de Geografia e Estatística*) Automatic Recovery System (*SIDRA*) Agricultural Production Report – Table 5457
	Soy planted	Dummy variable with a value equal to 1 if the municipality has soy planted and zero otherwise	IBGE´s - (*Instituto Brasileiro de Geografia e Estatística*) Automatic Recovery System (*SIDRA*)
	Ln agriculture expenditure	Natural logarithm from the municipal agriculture expenditure. Composition of municipal agricultural expenditure: credit for plant and animal production, health defense, supply, rural extension, irrigation, land reform, and colonization. We calculated the average agricultural expenditure on each municipality for three terms (2005/2008,2009/2012, 2013/2016)	The Brazilian National Treasury (https://www.gov.br/tesouronacional/pt-br/estados-e-municipios).
	Without IPTU´s collection	Dummy variable for the municipality which is not collecting IPTU (property tax) and zero otherwise (three terms: 2005/2008,2009/2012, 2013/2016)	

Table A1 – Panel C: Label, construction, and source of variables

Label		Construction	Source
Municipal Characteristics	**Ln public safety expenditure**	Natural logarithm from the municipal public safety expenditure. Composition of municipal public safety expenditure: public security, policing, and civil defense. We calculated the average public safety expenditure on each municipality for three terms (2005/2008,2009/2012, 2013/2016)	The Brazilian National Treasury (https://www.gov.br/tesouronacional/pt-br/estados-e-municipios).
	Ln housing and urbanism expenditure	Natural logarithm from the municipal housing and urbanism expenditure. Composition of municipal housing and urbanism expenditure: infrastructure, urban services, and urban housing. We calculated the average housing and urbanism expenditure on each municipality for three terms (2005/2008,2009/2012, 2013/2016)	
	ISS incentive	Dummy variable with a value equal to one whether the municipality has ISS (service tax) incentive and zero otherwise (three terms: 2005/2008,2009/2012, 2013/2016)	Survey of Basic Municipal Information - *MUNIC (IBGE):* the term 2005-2008 (information on the 2006 *MUNIC*), the term 2009-2012(information on the 2012 *MUNIC*), the term 2013-2016 (information on the 2015 *MUNIC*)
	Fee incentive	Dummy variable with a value equal to one whether the municipality has Fee incentive and zero otherwise (three terms: 2005/2008,2009/2012, 2013/2016)	
	Non-Profit Organizations for Environment and/or Animal Protection(NPOEAP)	Dummy variable with a value equal to one whether the municipality has a Non-Profit Organization for environment and/or animal protection and zero otherwise (three terms: 2005/2008,2009/2012, 2013/2016).	Platform of the Brazilian Civil Society Organizations - Institute for Applied Economic Research (*IPEA*). We have considered the year of creation of each NPO since 1967. For example, if for term 2005-2008 exists register of NPO since 1967 to 2008, the municipality was considered with dummy equal to one and zero otherwise, and so on. https://mapaosc.ipea.gov.br/
Leader´s characteristics	**Agribusiness leader**	Dummy variable with a value equal to one whether the municipality has professional in agribusiness (cattle breeder and agribusiness owner) elect as mayor and zero otherwise.	Superior Electoral Court (*TSE*); election year for mayors (2004, 2008, and 2012)
	Other mayors (classified by occupation)	Dummy variable with a value equal to one whether the municipality has professional in the lawyer, physician, etc as elect as mayor and zero otherwise.	
Firm with environmental projects	**XXX firm**	Dummy variable with a value equal to one whether the municipality has project of environment developed by XXX firm and zero otherwise.	The XXX firm offered information about their projects in the legal amazon (data which the project was implemented) from 1999 to 2019

ONLINE APPENDIX B – TSE´CLASSIFICATION OF OCCUPATIONS AND OUR AGGREGATION OF OCCUPATIONS

Table B1 – Panel A: Frequency of occupations of elected mayors

Occupation	Number of mayors	Frequency	Accumulated Frequency
Mayor	404	11,18%	11,18%
Business Owner	341	9,44%	20,61%
Other	293	8,11%	28,72%
Merchant	221	6,12%	34,84%
Physician	196	5,42%	40,26%
Cattle Breeder	166	4,59%	44,85%
Agribusiness Owner	156	4,32%	49,17%
State Public Servant	142	3,93%	53,10%
Lawyer	110	3,04%	56,14%
Administrator	86	2,38%	58,52%
Not Informed	84	2,32%	60,85%
Councilor	84	2,32%	63,17%
Business Owner*	81	2,24%	65,41%
Municipal Public Servant	72	1,99%	67,40%
Engineer	71	1,96%	69,37%
Basic Education Professor	64	1,77%	71,14%
Agricultural Producer	57	1,58%	72,72%
Agricultural Worker	56	1,55%	74,27%
High School Professor	49	1,36%	75,62%
Accountant	47	1,30%	76,92%
Livestock Worker	43	1,19%	78,11%
President / Ministers	37	1,02%	79,14%
Agricultural Business Owner	36	1,00%	80,13%
Federal Public Servant	36	1,00%	81,13%
Executive Branch Members	34	0,94%	82,07%
Basic Education Professor	34	0,94%	83,01%
Dentist	27	0,75%	83,76%
Agronomist	26	0,72%	84,48%
Agronomy Technician	24	0,66%	85,14%
Salesperson	21	0,58%	85,72%
Economist	20	0,55%	86,28%
High School Professor	20	0,55%	86,83%
Housewife	18	0,50%	87,33%
Congressman	17	0,47%	87,80%

Table B1 – Panel B: Frequency of occupations of elected mayors

Banker	15	0,42%	88,21%
Public Spectacles Producer	14	0,39%	88,60%
Rural Worker	14	0,39%	88,99%
Veterinary	14	0,39%	89,37%
Administrative Agent	13	0,36%	89,73%
Student	13	0,36%	90,09%
Justice Department Servant	13	0,36%	90,45%
Retired Public Servant	13	0,36%	90,81%
Accounting Technician	13	0,36%	91,17%
Pedagogue	12	0,33%	91,51%
Retired	11	0,30%	91,81%
Social Assistant	11	0,30%	92,11%
Industrial	11	0,30%	92,42%
Industrial Business Owner	11	0,30%	92,72%
Nurse	10	0,28%	93,00%
Senator	10	0,28%	93,28%
Driver	10	0,28%	93,55%
Clergyman	10	0,28%	93,83%
Senator, Deputy and Councilor	10	0,28%	94,11%
Serviceman	9	0,25%	94,36%
Driver (Collective Transport)	9	0,25%	94,60%
Manager	8	0,22%	94,83%
Radio and Television Commentator	8	0,22%	95,05%
Notary	8	0,22%	95,27%
Office Assistant	7	0,19%	95,46%
Pharmaceutical	7	0,19%	95,66%
Accounting Technician	7	0,19%	95,85%
Electrician	6	0,17%	96,02%
Driver	6	0,17%	96,18%
Nurse Technician	6	0,17%	96,35%
Fiscal	5	0,14%	96,49%
Fisherman	5	0,14%	96,62%
Police Officer	5	0,14%	96,76%

Note: 1) Occupations with less than 5 appearances have been discarded in the present Table. 2) Similar occupations have been compiled in the final sample. 3) We observe several modifications on the way professions have been described during the electoral periods analyzed, although these modifications have not interfered on the most prevalent occupations.

Table B2: Frequency of occupations of elected mayors after compiling similar occupations

Occupation	Number of mayors	Frequency
Politicians	488	22,10%
Mayor	404	18,30%
Business Owner	341	15,44%
Agribusiness	322	14,58%
Public Servant	274	12,41%
Merchant	221	10,01%
Physician	196	8,88%
Professors	170	7,70%
Lawyer	110	4,98%
Administrators	86	3,89%
	Total	100%

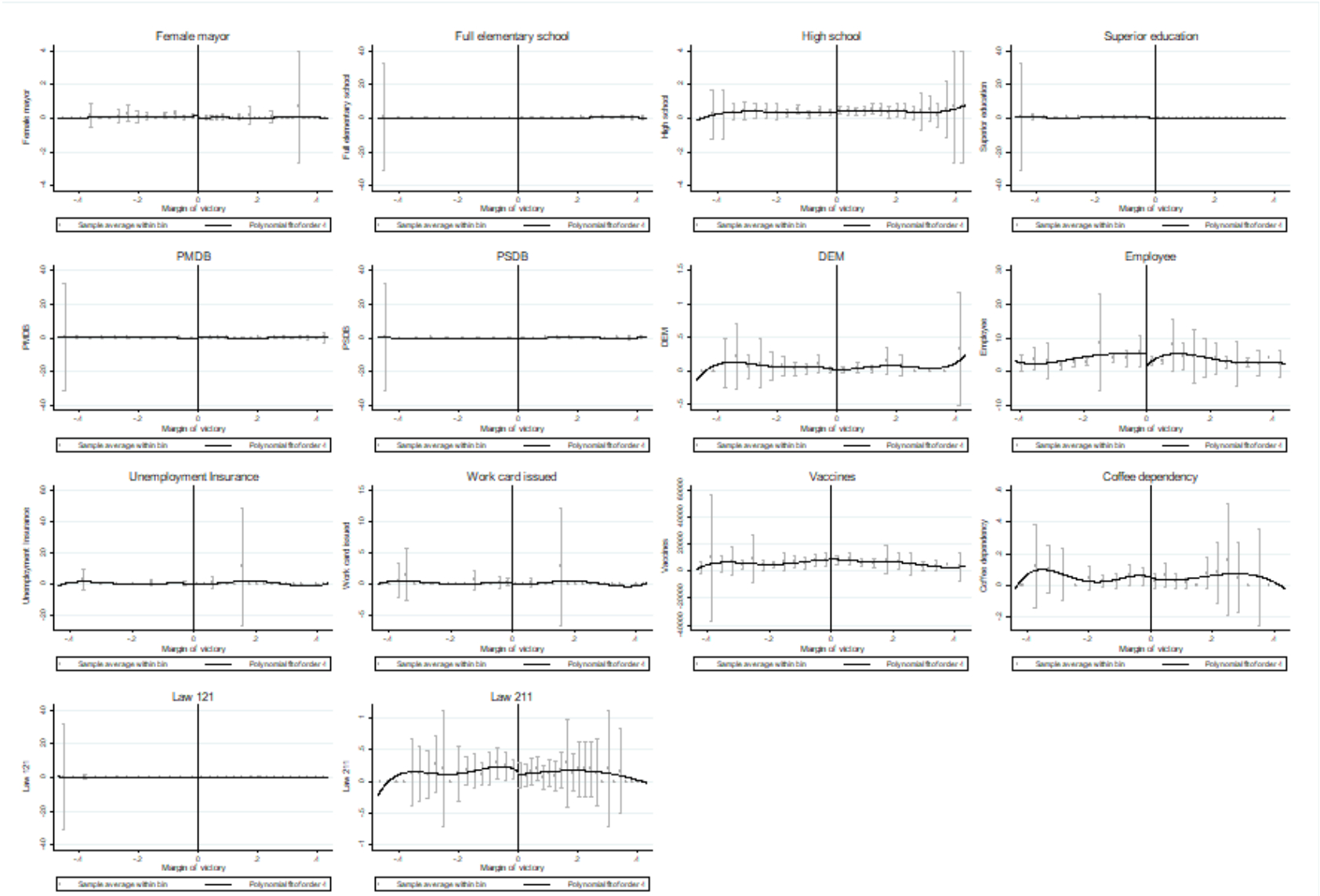
ONLINE APPENDIX C – EVIDENCE OF COVARIATES`BALANCING

Table C1: RD estimate on covariates

	Agribusiness vs. Other occupation – RD estimate - Covariates		
	Obs.	Obs. Effective	coef/s.e.
Female mayor	412	299	-0.102/0.0844
Full elementary school	412	276	-0.0164/0.151
High School	412	355	0.0544/0.155
Superior education	412	286	0.00261/0.178
PSDB (Brazilian Social Democracy Party)	412	307	0.0519/0.103
DEM (Liberal Party)	412	303	-0.0769/0.0700
MDB (Brazilian Democratic Movement Party)	412	279	0.0975/0.0856
Employee	316	245	-3.582/2.204
Unemployment insurance	374	157	-0.167/0.565
Work card issued	374	242	-0.573/0.444
Vaccines	392	293	777.8/3,003
Coffee dependency	392	254	-0.0373/0.0324
Environmental zoning legislation -Law 121	412	298	0.199/0.119*
Environmental impact analysis legislation – Law 211	412	321	0.0649/0.106
The 2004 election	412	277	-0.168/0.190
The 2008 election	412	291	-0.0742/0.128
The 2012 election	412	296	0.217/0.171

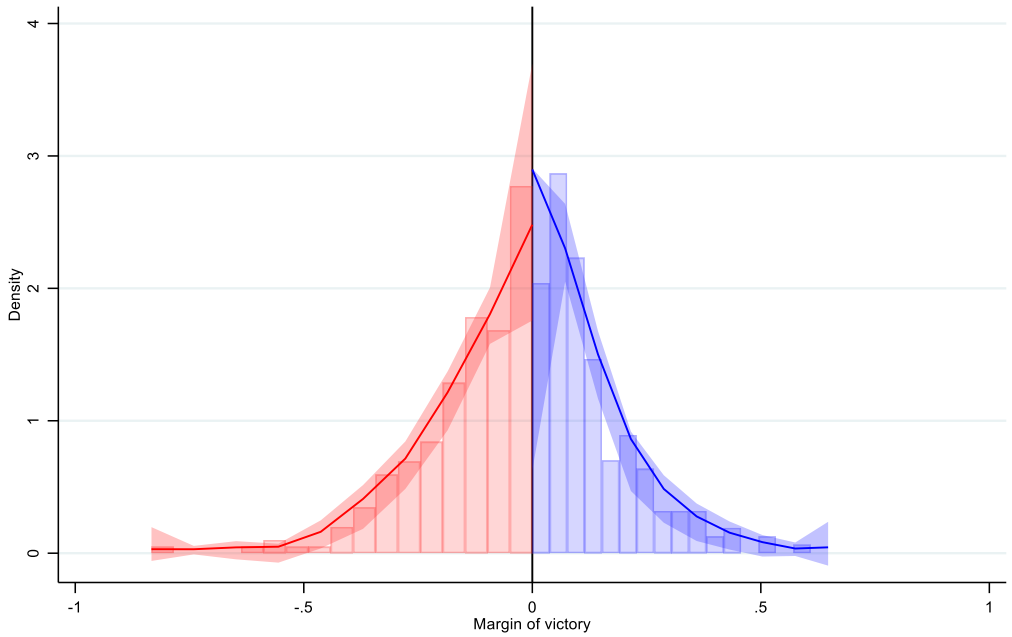
Notes: * Significance at the 10% level, ** at 5% level, and *** at 1% level; Robust standard errors clustered at the municipal level; 1) Bias-corrected RD estimates with robust variance estimator using Calonico *et al.* (2014); 2) Standard error adjusted for clusters in municipality; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011).

Figure C1: Covariates



ONLINE APPENDIX D – EVIDENCE OF ELECTORAL NON-MANIPULATION

Figure D1 – Manipulation tests – 2004, 2008, and 2012 elections



Note: Test null hypothesys (robust): -1.2006 (p-value=0.227); Cattaneo et al. (2008)

ONLINE APPENDIX E – ILLUSTRATIVE EXAMPLES OF MUNICIPAL DIRECT EXPENDITURES

Our results suggest that agribusiness mayors use direct expenditures on agricultural incentives and housing and urbanism investments to promote higher economic development. We analyzed media content published during the period analyzed concerning actions that could exemplify the expenditures empirically found as the mechanism used by these local leaders when elected.

One of these examples is the municipality of Cruzeiro do Sul, the second biggest municipality of the state of Acre in the North region of Brazil. According to its former mayor Vagner Sales[17], the investments during the 8 years of his mandate (including his re-election) surpassed R$ 180 million (around US$ 35 million considering values of 2022). Vagner focused on building municipal markets that allowed small entrepreneurs to sell their products directly to final consumers. These markets served more than 7000 people weekly. The mayor also invested in 11 trucks and 24 boats to help local producers transport their products and infrastructure improvements such as one asphalt plant and wi-fi connection.

Figure E1: Agricultural and infrastructure investments in Cruzeiro do Sul

Source: Ac24horas website[1]

Another example comes from the municipality of Bonfim in the state of Roraima. In this case the municipality acquired 5 tractors and some equipment to stimulate the local agricultural production, especially in some indigenous communities[18]. In this specific case, the financial resource came from a parliamentary amendment by Federal Deputy Édio Lopes, but the allocation of this resources was responsibility of Lisete Spies, one of the agribusiness mayors elected of our sample.

[17] https://ac24horas.com/2017/01/01/vagner-sales-um-prefeito-que-marcou-historia-em-cruzeiro-do-sul/

[18] https://www.ediolopes.com.br/2016/08/19/bonfim-recebe-maquinas-para-fortalecer-trabalho-de-produtores/

Figure E2: Tractors and equipment acquired by Bonfim's administration

Source: Federal Deputy Édio Lopes' website[2]

ONLINE APPENDIX F – EXPLORING THE IMPORTANCE OF TYPES OF AGRIBUSINESS ACTIVITIES

Considering that the occupation of an agribusiness leader is linked to an economic activity (agribusiness which involves the municipal herd and planted area; remember that the declared occupation these leaders are cattle breeders and agribusiness owners), we decide to explore the importance of different heterogeneities of sample on creation of the number of firms. We use the same methodology of our main results.

We observe municipalities with different sizes of the total herd (municipalities above and below the median on the Legal Amazon region; see Barreto et al., 2008), the most important group between the total herd, livestock (municipalities above and below the median on the Legal Amazon region; see Garcia et al., 2017), total planted area (the same, municipalities above and below the median on the Legal Amazon region), and municipalities without or with soy planted (soy is the planted area on expansion on region and it is basically exported; see Garrett, 2018; Kock et al., 2019; Carpentier et al., 2000).

Table F1: Agribusiness leader effect on sustainable development – heterogeneities

	Non parametric RD							
	Dependent variable:							
	Number of new firms							
	Posterior to 2004							
	Second-degree polynomial							
	Total herd		Livestock		Total planted area		Municipalities	
	Above Median	Below Median	Above Median	Below Median	Above Median	Below Median	Without Soy Planted	With Soy Planted
	Considering all municipalities from the sample							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Agribusiness mayor	13.52	0.368	16.07	-0.278	9.856	14.90	-5.098	36.29
	(6.908)	(0.660)	(7.555)	(2.755)	(5.968)	(14.11)	(2.827)	(10.93)
P-value	**0.050**	**0.577**	**0.033**	**0.920**	**0.099**	**0.291**	**0.071**	**0.001**
Number of observations	232	120	246	106	212	140	216	136
Effective number of observations	152	53	152	68	129	104	143	68
Considered bandwidth	0.169	0.101	0.164	0.134	0.143	0.203	0.169	0.109

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

Electoral manipulation (McCrary test): We do not find evidence of electoral manipulation for municipalities which the total herd and livestock area above median in the Amazon Legal region and municipalities with soy planted. The results can be seen below.

Balancing of covariates: We investigate with the same methodology of main results whether the same covariates from main results are balanced for municipalities which the total herd and livestock area above median in the Amazon region and municipalities with soy planted. We find evidence that they are balanced. The results can be seen below.

Independent variable (definition): Agribusiness mayor is a dummy variable with a value equal to one whether the municipality has professional in agribusiness elect as mayor and zero otherwise.

Dependent variable (definition): Number of new firms is the number of new firms created in the municipality per term

Our results come from municipalities in which the total herd is above the median on the Legal Amazon region (municipalities with agribusiness leader create more 13.52 new firms, p=0.050) and basically it is present in municipalities with livestock above the median (municipalities with agribusiness leader create more 16.07 new firms, p=0.033). Additionally, the result is also important whether the municipality has soy planted. In this case, the effect is strong: municipalities with agribusiness leaders create more 36.29 new firms, p=0.001).

In sequence, we show evidence of non-electoral manipulation and balancing of covariates into these groups of the sample.

Figure F1 – Manipulation tests – Herd above median

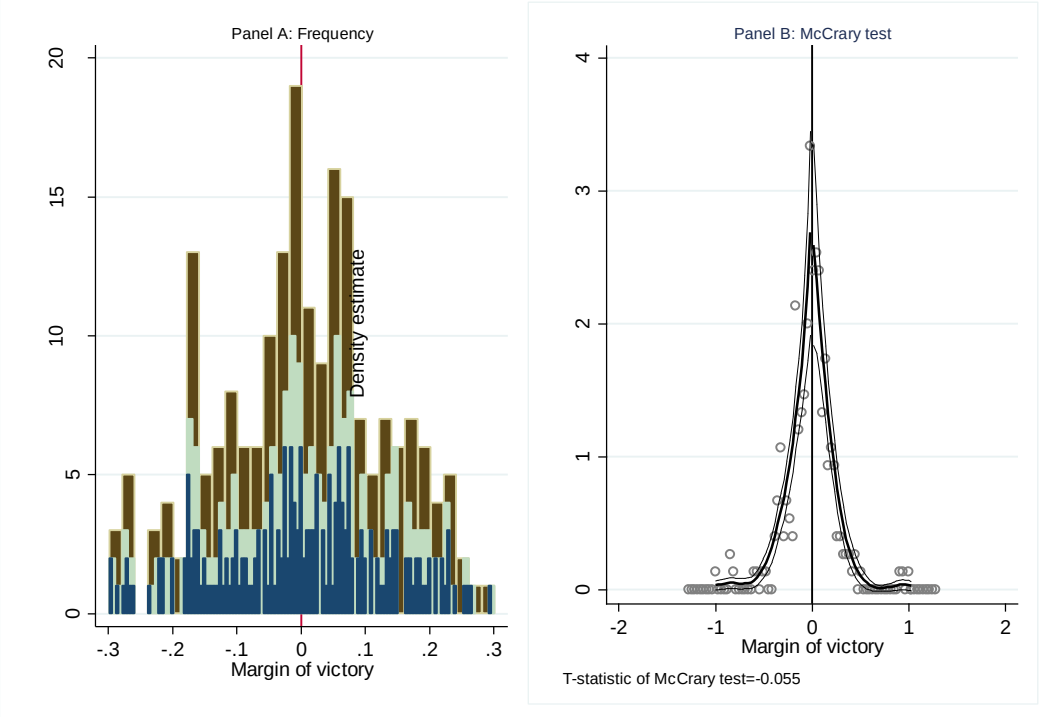


Figure F2 – Manipulation tests – Livestock above median

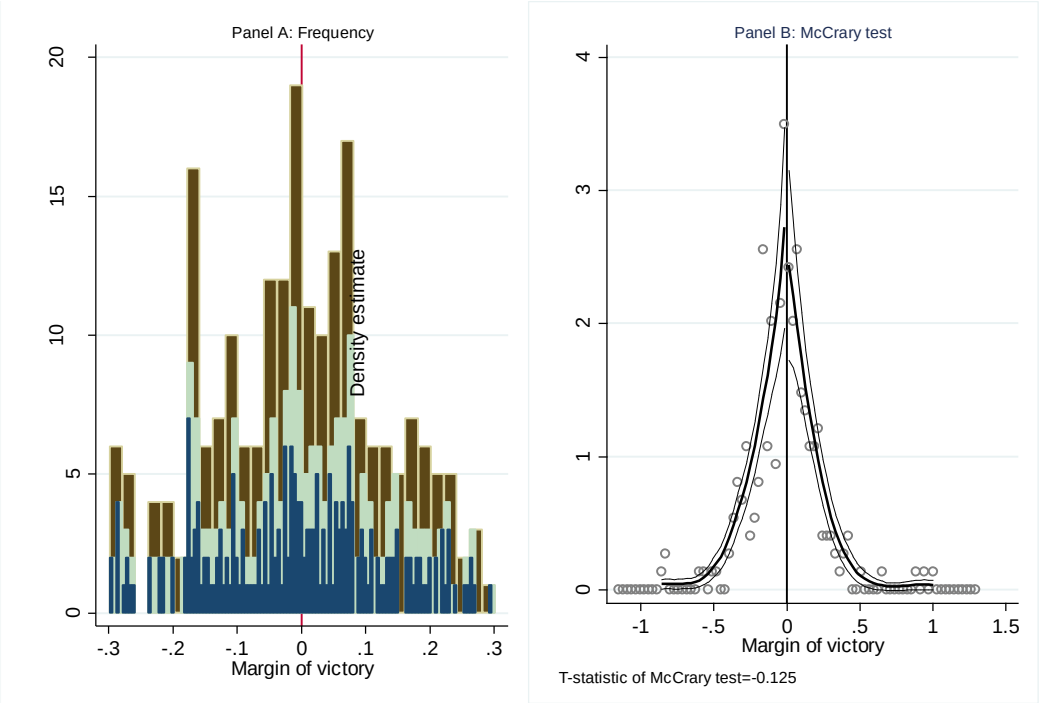


Figure F3 – Manipulation tests – Municipalities with Soy Planted

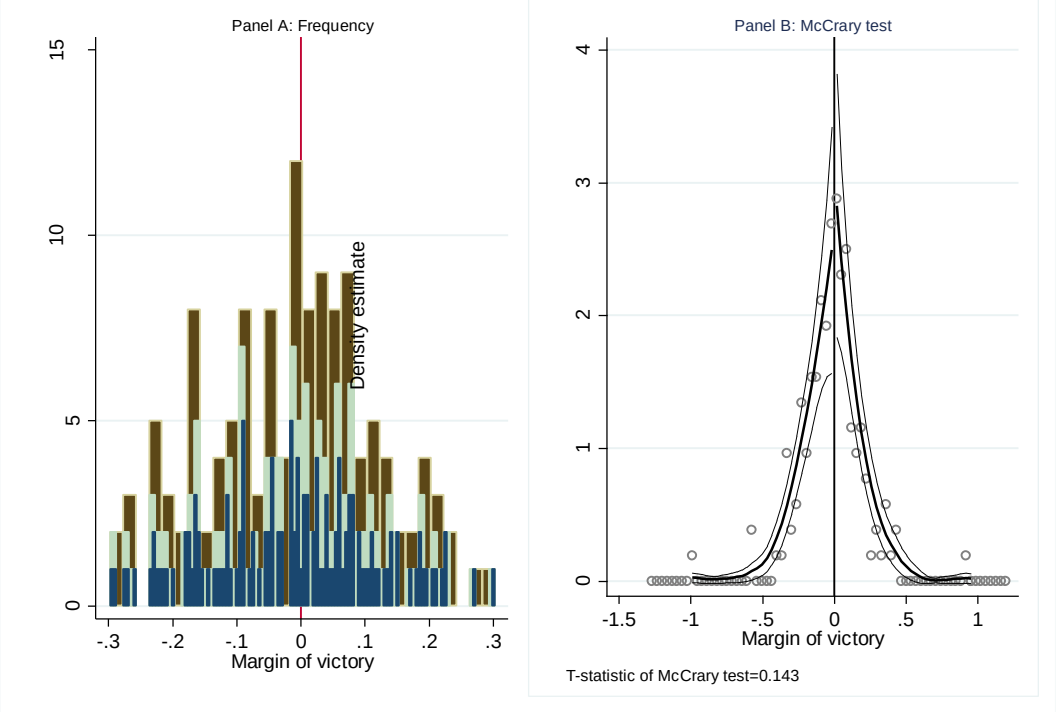


Table F2: RD estimate on covariates from different samples

	Total Herd above median			Livestock above median			Municipalities with soy planted		
	Obs.	Obs. Effective	Obs.	Obs.	Obs.	coef/s.e.	Obs.	Obs. Effective	coef/s.e.
Female mayor	244	182	-0.179/0.104*	256	184	-0.218/0.103**	150	86	-0.0522/0.065
Full elementary school	244	161	-0.135/0.202	256	176	0.0371/0.190	150	74	-0.324/0.166*
High School	244	174	0.411/0.225*	256	196	0.275/0.220	150	91	0.0472/0.335
Superior education	244	178	-0.201/0.213	256	203	-0.266/0.186	150	107	0.0696/0.291
PSDB (Brazilian Social Democracy Party)	244	174	0.0329/0.148	256	184	0.0723/0.152	150	95	0.0286/0.204
DEM (Liberal Party)	244	148	-0.0180/0.0538	256	145	2.59e-05/0.052	150	89	-0.193/0.188
MDB (Brazilian Democratic Movement Party)	244	167	0.157/0.114	256	178	0.144/0.126	150	87	0.275/0.200
Employee	223	172	-4.833/2.794*	231	172	-4.988*/3.003	130	85	-3.579/3,120
Unemployment insurance	218	98	-0.292/0.937	227	88	-0.213/1.096	137	67	0.789/0.881
Work card issued	218	145	-0.723/0.710	227	176	-0.639/0.580	137	76	0.201/0.245
Vaccines	234	167	-443.1/4,378	244	195	-857.5/3,965	144	84	7,427/4,483*
Coffee dependency	234	171	-0.0493/0.0493	244	171	-0.0555/0.0508	144	68	0.0319/0.0186*
Environmental zoning legislation - Law 121	244	182	0.126/0.136	256	188	0.175/0.143	150	108	0.300/0.177*
Environmental impact analysis legislation – Law 211	244	174	-0.127/0.111	256	198	-0.0854/0.108	150	88	-0.178/0.132
The 2004 election	244	174	-0.0515/0.232	256	184	0.0694/0.227	150	94	0.0323/0.315
The 2008 election	244	167	-0.115/0.163	256	156	-0.188/0.186	150	91	-0.408/0.190**
The 2012 election	244	182	0.106/0.210	256	203	-0.117/0.199	150	91	0.445/0.306

Notes: * Significance at the 10% level, ** at 5% level, and *** at 1% level; Robust standard errors clustered at the municipal level; 1) Bias-corrected RD estimates with robust variance estimator using Calonico *et al.* (2014); 2) Standard error adjusted for clusters in municipality; 3) Municipalities with

more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011). **4)** Between women, agribusiness leader has a systematic electoral advantage. Specific study is necessary to understand this result, and this lies outside the scope of our investigation here. Observing Lee´s *et al.* (2004) paper, we see that the black population percentage was the only unbalanced covariate in a set of covariates; **5)** The 2008 election is less favorable for the agribusiness leader. However, the same result did not observe for other elections (2004 and 2012). Thus, there is not a systematic electoral disadvantage for the agribusiness leader.

ONLINE APPENDIX G – FISCAL INSTRUMENTS FOR DIFFERENT HETEROGENEITIES OF SAMPLE

Table G1: Fiscal instruments use by agribusiness leader in municipalities with either herd above median or with soy planted

	Non parametric RD											
	Posterior to 2004											
	Second-degree polynomial											
	Municipalities						Considering all municipalities from the sample					
	With soy planted						Above median - livestock					
	Dependent variables:											
	Ln agricultural expenditure	Ln Public safety expenditure	Ln Housing and Urbanism expenditure	Without IPTU´s collection	ISS incentive	Fee incentive	Ln agricultural expenditure	Ln Public safety expenditure	Ln Housing and Urbanism expenditure	Without IPTU´s collection	ISS incentive	Fee incentive
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Agribusiness mayor	2.6421	1.524	2.817	-0.0418	-0.160	0.0385	0.71485	-0.627	0.273	-0.0145	-0.228	-0.0116
	1.132	(1.297)	(0.735)	(0.0742)	(0.233)	(0.0819)	0.75595	(1.731)	(0.704)	(0.0838)	(0.157)	(0.128)
P-value	**0.02**	**0.24**	**0.000**	**0.573**	**0.491**	**0.638**	**0.217**	**0.717**	**0.698**	**0.863**	**0.146**	**0.928**
Number of observations	146	62	149	150	150	150	250	88	253	256	256	256
Effective number of observations	85	41	76	85	96	85	185	64	187	169	187	187
Considered bandwidth	0.135	0.147	0.11	0.128	0.158	0.128	0.217	0.198	0.216	0.174	0.208	0.21

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

Electoral manipulation (McCrary test): We do not find evidence of electoral manipulation for municipalities which the municipalities have soy planted and the livestock is above median.

Balancing of covariates: We investigate with the same methodology of main results whether the same covariates from main results are balanced for municipalities with soy planted and with livestock is above median. We find evidence that they are balanced.

Independent variable (definition): Agribusiness mayor is a dummy variable with a value equal to one whether the municipality has professional in agribusiness elect as mayor and zero otherwise.

Dependent variables (definitions): Ln Agricultural expenditure is the natural logarithm from the municipal agricultural expenditure per term; **Ln Public Safety expenditure** is the natural logarithm from the municipal public safety expenditure per term; **Ln Housing and Urbanism expenditure** is the natural logarithm from the municipal housing and urbanism expenditure per term**; Without IPTU´s collection** is the municipality which is not collection IPTU (property tax); **ISS incentive** is a dummy with a value equal to one whether the municipality has ISS (service tax) incentive and zero otherwise; **Fee incentive** is a dummy with a value equal to one whether the municipality has Fee incentive and zero otherwise.

ONLINE APPENDIX H – FISCAL INSTRUMENTS

Table H1: Agribusiness leader using fiscal instruments to produce sustainable development (number of new firms and deforestation) in municipalities with soy planted

	Non parametric RD						
	Municipalities with soy planted using fiscal instruments						
	Dependent variables:						
	Number of new firms					**Deforestation**	
	Posterior to 2004						
	Second-degree polynomial	**Third-degree polynomial**	**Second-degree polynomial**			**Second-degree polynomial**	**Third-degree polynomial**
			Different fixed bandwidths				
Panel A:	**Fiscal instrument: Municipalities with agricultural expenditure**						
	[1A]	[2A]	[3A]	[4A]	[5A]	[6A]	[7A]
Agribusiness mayor	35.40	37.21	34.44	32.62	23.64	-47.30	-35.08
	(10.84)	(11.76)	(11.83)	(9.848)	(8.283)	(44.87)	(50.19)
P-value	**0.001**	**0.002**	**0.004**	**0.001**	**0.004**	**0.292**	**0.485**
Number of observations	132	132	132	132	132	146	146
Effective number of observations	66	83	61	97	114	100	104
Considered bandwidth	0.112	0.158	**0.10**	**0.20**	**0.30**	0.175	0.186
Panel B:	**Fiscal instrument: Municipalities with housing and urbanization expenditure**						
	[1B]	[2B]	[3B]	[4B]	[5B]	[6B]	[7B]
Agribusiness mayor	36.28	38.04	35.01	32.62	23.49	-41.59	-32.48
	(10.92)	(11.83)	(11.85)	(9.805)	(8.195)	(43.06)	(47.85)
P-value	**0.001**	**0.001**	**0.003**	**0.001**	**0.004**	**0.334**	**0.497**
Number of observations	135	135	135	135	135	149	149
Effective number of observations	67	85	64	100	117	100	109
Considered bandwidth	0.109	0.157	**0.10**	**0.20**	**0.30**	0.171	0.192

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016.

Electoral manipulation (McCrary test): We do not find evidence of electoral manipulation for municipalities with soy planted either with agricultural expenditure or with housing and urbanization expenditure.

Balancing of covariates: We investigate with the same methodology of main results whether the same covariates from main results are balanced for municipalities with soy planted either with agricultural expenditure or with housing and urbanization expenditure. We find evidence that they are balanced.

Independent variable (definition): Agribusiness mayor is a dummy variable with a value equal to one whether the municipality has professional in agribusiness elect as mayor and zero otherwise.

Dependent variables (definitions): Number of new firms is the number of new firms created in the municipality per term; **Deforestation** is the number of acres deforested in the municipality per term.

Table H2: RD estimate on covariates from different samples

	Municipalities with soy planted and with agricultural expenditure			Municipalities with soy planted and with housing and urbanism expenditure		
	Obs.	Obs. Effective	coef/s.e.	Obs.	Obs. Effective	coef/s.e.
Female mayor	146	82	-0.0356/0.062	149	85	-0.0536/0.0652
Full elementary school	146	72	-0.279/0.172	149	73	-0.321/0.166*
High School	146	88	0.0806/0.335	149	90	0.0508/0.336
Superior education	146	105	0.0269/0.297	149	106	0.0797/0.291
PSDB (Brazilian Social Democracy Party)	146	93	0.0417/0.207	149	94	0.0278/0.204
DEM (Liberal Party)	146	87	-0.213/0.195	149	88	-0.194/0.187
MDB (Brazilian Democratic Movement Party)	146	84	0.269/0.201	149	87	0.271/0.200
Employee	127	66	-0.179/2.239	129	84	-3.578/3.112
Unemployment insurance	134	61	0.786/0.868	136	66	0.797/0.889
Work card issued	134	67	0.236/0.276	136	72	0.227/0.269
Vaccines	141	86	6,036/4,449	143	85	7,332/4,433*
Coffee dependency	141	65	0.0312/0.0183*	143	67	0.0321/0.0185*
Environmental zoning legislation -Law 121	146	103	0.304/0.181*	149	108	0.302/0.176*
Environmental impact analysis legislation – Law 211	146	85	-0.202/0.142	149	88	-0.178/0.132
The 2004 election	146	91	-0.0424/0.318	149	94	0.0318/0.314
The 2008 election	146	91	-0.449/0.197**	149	90	-0.406/0.189**
The 2012 election	146	85	0.579/0.299*	149	90	0.442/0.306

Notes: * Significance at the 10% level, ** at 5% level, and *** at 1% level; Robust standard errors clustered at the municipal level; 1) Bias-corrected RD estimates with robust variance estimator using Calonico *et al.* (2014); 2) Standard error adjusted for clusters in municipality; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); **4)** The 2008 election is less favorable for the agribusiness leader. However, the same result did not observe for other elections (2004 and 2012). Thus, there is not a systematic electoral disadvantage for the agribusiness leader.

Figure H1 – Manipulation tests – Municipalities with Soy Planted Area and Agricultural Expenditure

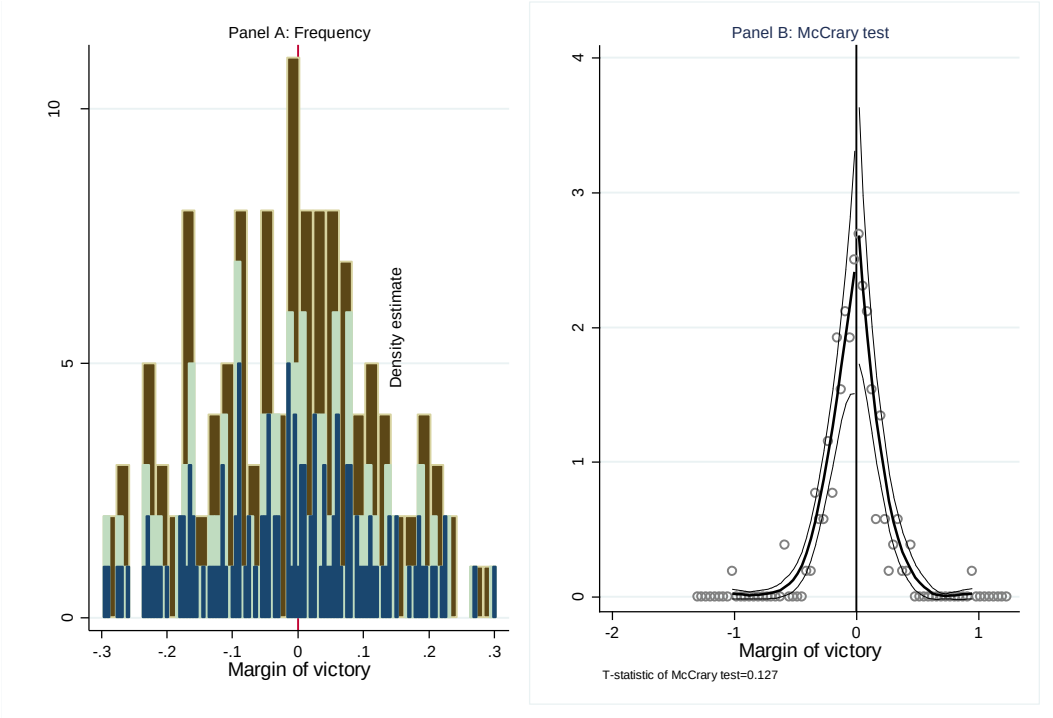
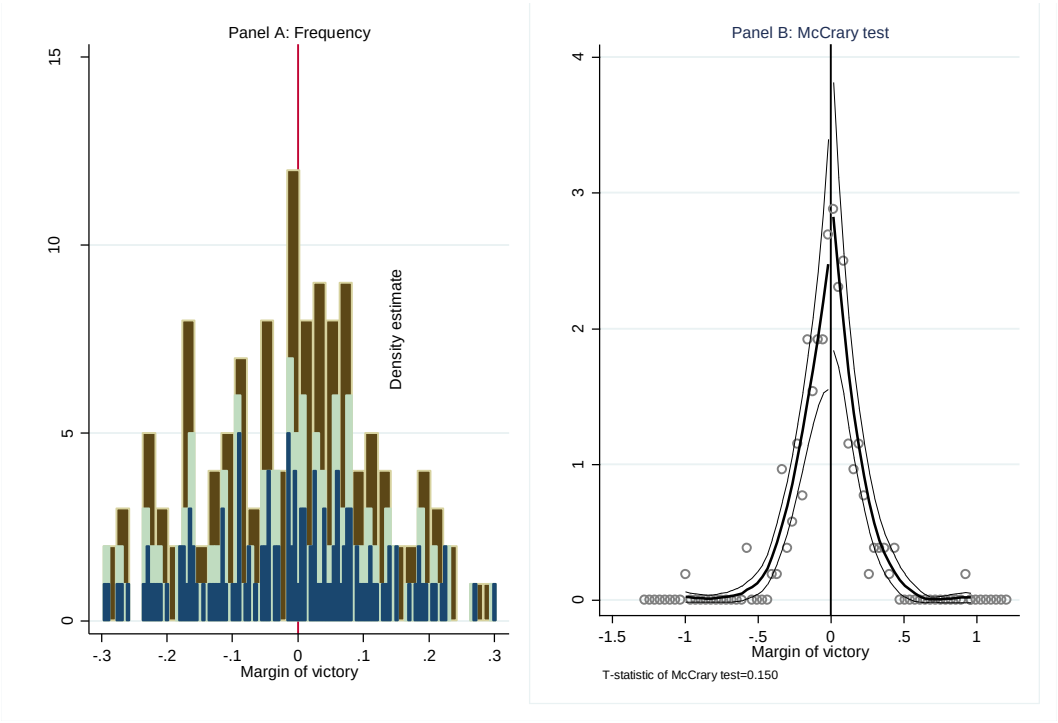


Figure H2 – Manipulation tests – Municipalities with Soy Planted Area and Housing and Urbanism Expenditure



ONLINE APPENDIX I – EFFECT OF OTHER OCCUPATIONS AS MAYOR ON NEW FIRMS AND DEFORESTATION

Table I1: Investigation on other occupations

	Administrator	*Lawyer*	*Merchant*	*Business Owner*	*Physician*
	RD estimate (1)	RD estimate (2)	RD estimate (3)	RD estimate (4)	RD estimate (5)
Number of new firms	0.495	3.236	-2.353	4.939	-5.680
	(4.899)	(8.822)	(3.217)	(5.148)	(25.93)
P-value	**0.919**	**0.714**	**0.465**	**0.337**	**0.827**
Number of observations	459	373	273	294	170
Effective number of observations	299	282	198	223	132
Considered bandwidth	0.163	0.201	0.191	0.208	0.204
Deforestation	-37.40	-30.77	-24.24	12.14	27.64
	(40.07)	(35.72)	(27.71)	(40.31)	(32.14)
P-value	**0.351**	**0.389**	**0.382**	**0.763**	**0.39**
Number of observations	506	408	333	355	203
Effective number of observations	424	272	232	212	160
Considered bandwidth	0.25	0.157	0.178	0.141	0.204
	Mayor	*Professor*	*Councilor*	*Public Servant*	
	RD estimate (6)	RD estimate (7)	RD estimate (8)	RD estimate (9)	
Number of new firms	-1.033	11.55	8.465	-0.358	
	(2.354)	(23.53)	(11.06)	(5.878)	
P-value	**0.661**	**0.623**	**0.444**	**0.951**	
Number of observations	183	126	95	110	
Effective number of observations	103	87	47	72	
Considered bandwidth	0.119	0.156	0.105	0.151	
Deforestation	22.37	-35.07	95.45	-60.58	
	(32.12)	(29.12)	(141.4)	(51.94)	
P-value	**0.486**	**0.228**	**0.5**	**0.243**	
Number of observations	213	138	105	122	
Effective number of observations	150	85	65	66	
Considered bandwidth	0.164	0.135	0.141	0.116	

Note: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014). Standard errors in parentheses; 2) Municipalities with more than 200,000 electors are excluded to avoid the possibilities of a second round. 3) The bandwidth used in the RD results is generated endogenously (triangular kernel);4) Second-order polynomial.

ONLINE APPENDIX J – DIFFERENCES OF PRODUCTIVITY BETWEEN MUNICIPALITIES

Table J1: Internal productivity of Agribusiness

	Nonparametric RD	
	Dependent variables:	
	Soy planted	Corn planted
	Posterior to 2004	
	Second-degree polynomial	
	[1]	[2]
Agribusiness leader	647,319	37,249
	(454,764)	(44,333)
P-value	0.155	0.401
Number of observations	139	390
Effective number of observations	81	311
Considered bandwidth	0.132	0.236

Notes: 1) Bias-corrected RD estimates with robust variance estimator using Calonico et al. (2014); 2) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 4) Previous 2004 considers the 2000-2004 term; 5) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016. 5) The number of observations for the variable "Number of new firms" is lower than the variable "Deforestation" because we have less municipalities with the presence of new formal firms.

ONLINE K – PRIVATE FIRMS INFLUENCE

Table K1: Agribusiness leader effect on sustainable development (number of new firms and deforestation) with Non-Profit Organizations for Environment and/or Animal Protection (NPOEAP) and XXX firm with environment projects

	Parametric RD											
	Posterior to 2004											
	Without NPOEAP dummy as control				With NPOEAP dummy as control				With XXX firm dummy as control			
	Dependent variables:											
	Number of new firms		**Deforestation**		**Number of new firms**		**Deforestation**		**Number of new firms**		**Deforestation**	
	Btw +/- 10% margin	Full sample	Btw +/- 10% margin	Full sample	Btw +/- 10% margin	Full sample	Btw +/- 10% margin	Full sample	Btw +/- 10% margin	Full sample	Btw +/- 10% margin	Full sample
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Agribusiness mayor	5.511*	2.075*	-19.933	-32.322**	-	-	-	-	-	-	-	-
	(3.005)	(1.196)	(21.072)	(14.896)	-	-	-	-	-	-	-	-
P-value	**0.070**	**0.084**	**0.346**	**0.031**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Agribusiness mayor*NPOEAP	-	-	-	-	8.200	4.875	51.029	51.730*	-	-	-	-
	-	-	-	-	(7.702)	(9.181)	(33.696)	(29.794)	-	-	-	-
P-value	-	-	-	-	**0.289**	**0.596**	**0.133**	**0.084**	**-**	**-**	**-**	**-**
Agribusiness mayor*XXX firm	-	-	-	-	**-**	**-**	**-**	**-**	-11.721*	-5.546	-196.521	-108.202*
	-	-	-	-	**-**	**-**	**-**	**-**	(6.090)	(3.437)	(118.915)	(65.046)
P-value	-	-	-	-	**-**	**-**	**-**	**-**	**0.057**	**0.108**	**0.101**	**0.098**
Margin	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Margin²	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Covariates?	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	123	277	137	299	123	277	137	299	123	277	137	299
R^2	0.540	0.455	0.238	0.181	0.616	0.499	0.256	0.189	0.569	0.474	0.408	0.200

Notes: 1) Robust standard errors clustered at the municipal level; 3) Municipalities with more than 200,000 electors are excluded from the sample to avoid strategic possibilities in the second round (Fujiwara, 2011); 2) Posterior 2004 considers the terms 2005-2008, 2009-2012, 2012-2016; 3) Our parametric estimation is very similar those implemented by Flammer (2015) and Flammer and Bansal (2017). We control all results by the same covariates used on non-parametric estimate and added the margin of victory and the margin of victory squared; 3) The number of observations for the variable "Number of new firms" is lower than the variable "Deforestation" because we have less municipalities with the presence of new formal firms (see table 2)

Independent variables (definition): Agribusiness mayor is a dummy variable with a value equal to one whether the municipality has professional in agribusiness elect as mayor and zero otherwise; **Agribusiness mayor*NPOEAP** is the interaction between the dummy Agribusiness mayor and the dummy which indicate if the municipality has one NPOEAP; **Agribusiness mayor*XXX is** the interaction between the dummy Agribusiness mayor and the dummy which indicate if the municipality has one project from XXX firm

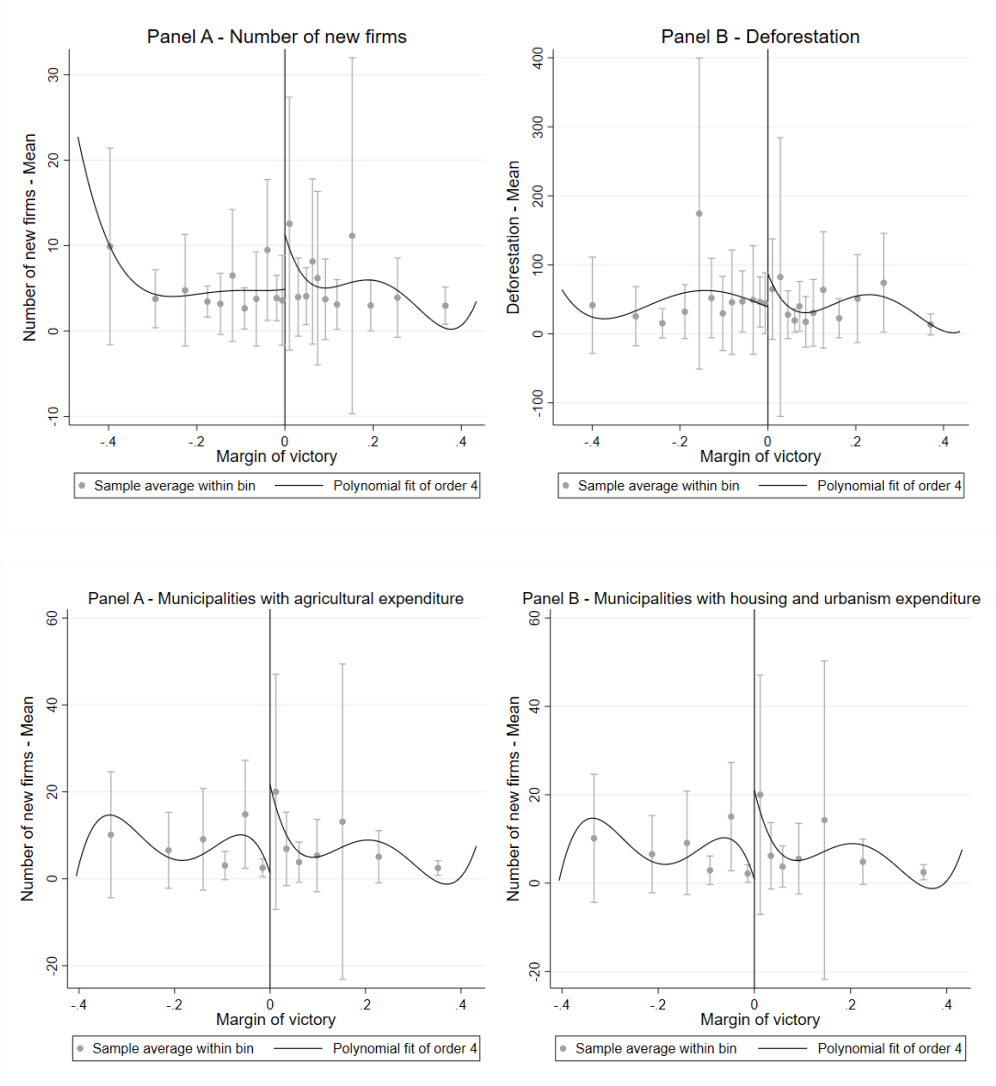
Dependent variables (definition): Number of new firms is the number of new firms created in the municipality per term; **Deforestation** is the accumulated deforestation was calculated as the sum of the annual deforestation (acres) during the four years in the term.

Covariates: Female mayor, Full elementary school, High School, Superior education, PSDB (Brazilian Social Democracy Party), DEM (Liberal Party), MDB (Brazilian Democratic Movement Party), Employee, Unemployment insurance, Work card issued, Vaccines, Coffee dependency, Environmental zoning legislation -Law 121, the 2004 election, the 2008 election, and the 2012 election; **With NPOEAP dummy as control results** also include as control both the dummy Agribusiness mayor and the dummy NPOEAP; **With XXX firm dummy as control** results also include as control both the dummy Agribusiness mayor and the dummy XXX firm

ONLINE APPENDIX L – QUANTILE-SPACED BINS

Following the procedures to implement RD methodology explicit in the text ("(4) show that the same discontinuity (in the cut-off point) observed in the estimates of dependent variables is visually observed in figures (inspecting the estimated version is a simple powerful way to visualize the identification strategy)"), we investigated if there is the jump around cut-off when we generate figures using QS (all figures in the text was generated using ES - bins that have equal length). The example below shows figures 3 and 4 of the first result using QS (bins that have equal length)

Figure L1 – RD Plots Using QS Bins



Although Panel B (deforestation) shows visually a little jump around the cut-off, this jump was not confirmed by estimations with significance statistics (a necessary condition for the results shown in item 4)19

[19] All figures using QS can be solicited for the authors.

ONLINE APPENDIX M – CORRELATION MATRIX

Table M1 – Correlation Matrix – Part A

	Agribusiness mayor	Female mayor	Full elementary school	High School	Superior education	PSDB (Brazilian Social Democracy Party)	DEM (Liberal Party)	MDB (Brazilian Democratic Movement Party)	Employee	Unemployment insurance
Agribusiness mayor	**1.000**	-0.054	0.138	0.073	-0.145	0.075	0.068	0.086	-0.004	0.025
Female mayor	-0.054	**1.000**	-0.076	-0.036	0.163	0.037	0.027	0.032	-0.024	0.042
Full elementary school	0.138	-0.076	**1.000**	-0.321	-0.385	0.024	-0.021	0.035	-0.023	0.023
High School	0.073	-0.036	-0.321	**1.000**	-0.541	0.013	0.005	0.009	-0.033	-0.012
Superior education	-0.145	0.163	-0.385	-0.541	**1.000**	0.033	0.049	0.042	0.033	-0.002
PSDB (Brazilian Social Democracy Party)	0.075	0.037	0.024	0.013	0.033	**1.000**	-0.014	-0.032	-0.005	-0.019
DEM (Liberal Party)	0.068	0.027	-0.021	0.005	0.049	-0.014	**1.000**	-0.017	0.004	0.022
MDB	0.086	0.032	0.035	0.009	0.042	-0.032	-0.017	**1.000**	0.005	-0.013
Employee	-0.004	-0.024	-0.023	-0.033	0.033	-0.005	0.004	0.005	**1.000**	0.007
Unemployment insurance	0.025	0.042	0.023	-0.012	-0.002	-0.019	0.022	-0.013	0.007	**1.000**
Work card issued	0.004	0.025	0.015	0.002	-0.018	-0.017	0.044	-0.021	0.010	0.807
Vaccines	-0.064	0.030	-0.061	-0.071	0.132	0.005	-0.012	0.024	0.028	0.035
Coffee dependency	0.040	-0.003	0.046	-0.020	-0.025	-0.003	-0.014	0.039	-0.066	-0.018
Environmental zoning legislation -Law 121	0.004	0.019	-0.023	-0.024	0.048	0.010	0.019	0.030	-0.012	0.033
Environmental impact analysis legislation – Law 211	0.015	0.009	-0.036	-0.033	0.064	-0.006	0.049	0.020	-0.006	0.069
Number of new firms	-0.010	0.026	-0.063	-0.013	0.109	-0.016	-0.004	0.055	0.002	0.072
Deforestation	-0.044	-0.007	0.056	-0.011	-0.040	0.071	-0.043	0.020	0.104	0.067
Total Herd	0.008	-0.010	-0.032	0.001	0.028	-0.008	0.040	0.008	0.027	0.104
Livestock	0.082	0.012	0.016	0.016	-0.013	-0.001	0.009	0.031	0.081	0.143
Total planted area	0.012	-0.038	-0.016	0.005	0.022	-0.010	0.015	-0.014	0.079	0.039
Soy planted	0.123	-0.036	0.044	-0.016	-0.092	0.223	0.079	0.272	-0.048	-0.017
Ln agriculture expenditure	-0.031	-0.021	-0.072	0.007	0.058	-0.021	-0.008	-0.013	0.029	0.051
Ln public safety expenditure	-0.061	-0.029	-0.048	-0.017	0.076	-0.076	-0.048	-0.063	0.070	0.015
Ln housing and urbanism expenditure	-0.048	-0.019	-0.090	-0.030	0.110	-0.034	-0.019	-0.023	0.072	0.039
Without IPTU's collection	0.051	-0.051	-0.005	-0.045	-0.080	0.095	0.005	0.078	0.013	-0.031
ISS incentive	-0.022	0.000	-0.026	0.015	0.015	-0.024	0.011	-0.012	-0.012	0.071
Fee incentive	-0.025	0.016	-0.028	0.012	0.014	-0.013	0.023	-0.018	-0.025	0.044
NPOEAP	-0.011	0.013	-0.036	0.000	0.066	-0.023	-0.016	-0.016	-0.006	0.019
Environmental conscientious firm	0.039	0.008	-0.001	0.010	0.033	0.072	0.068	0.099	0.020	0.030
The 2004 election	0.080	-0.014	0.055	0.029	0.005	0.019	-0.090	-0.046	0.034	-0.075
The 2008 election	0.047	0.004	0.017	0.054	0.025	-0.052	0.185	0.030	0.030	-0.069

The 2012 election	0.009	0.064	-0.022	0.043	0.066	-0.042	0.022	0.053	-0.062	0.143

Table M1 – Correlation Matrix – Part B

	Work card issued	**Vaccines**	**Coffee dependency**	**Environmental zoning legislation - Law 121**	**Environmental impact analysis legislation – Law 211**	**Number of new firms**	**Deforestation**	**Total Herd**	**Livestock**	**Total planted area**
Agribusiness mayor	0.004	-0.064	0.040	0.004	0.015	-0.010	-0.044	0.008	0.082	0.012
Female mayor	0.025	0.030	-0.003	0.019	0.009	0.026	-0.007	-0.010	0.012	-0.038
Full elementary school	0.015	-0.061	0.046	-0.023	-0.036	-0.063	0.056	-0.032	0.016	-0.016
High School	0.002	-0.071	-0.020	-0.024	-0.033	-0.013	-0.011	0.001	0.016	0.005
Superior education	-0.018	0.132	-0.025	0.048	0.064	0.109	-0.040	0.028	-0.013	0.022
PSDB (Brazilian Social Democracy Party)	-0.017	0.005	-0.003	0.010	-0.006	-0.016	0.071	-0.008	-0.001	-0.010
DEM (Liberal Party)	0.044	-0.012	-0.014	0.019	0.049	-0.004	-0.043	0.040	0.009	0.015
MDB	-0.021	0.024	0.039	0.030	0.020	0.055	0.020	0.008	0.031	-0.014
Employee	0.010	0.028	-0.066	-0.012	-0.006	0.002	0.104	0.027	0.081	0.079
Unemployment insurance	0.807	0.035	-0.018	0.033	0.069	0.072	0.067	0.104	0.143	0.039
Work card issued	**1.000**	0.044	-0.010	-0.009	0.040	0.065	0.111	0.056	0.197	0.010
Vaccines	0.044	**1.000**	-0.009	0.114	0.283	0.573	0.108	0.112	0.135	0.032
Coffee dependency	-0.010	-0.009	**1.000**	0.070	0.075	0.060	0.110	0.066	0.268	-0.036
Environmental zoning legislation -Law 121	-0.009	0.114	0.070	**1.000**	0.450	0.144	-0.002	0.011	0.077	0.043
Environmental impact analysis legislation – Law 211	0.040	0.283	0.075	0.450	**1.000**	0.261	-0.019	0.041	0.078	0.028
Number of new firms	0.065	0.573	0.060	0.144	0.261	**1.000**	0.012	0.215	0.179	0.204
Deforestation	0.111	0.108	0.110	-0.002	-0.019	0.012	**1.000**	0.086	0.316	0.049
Total Herd	0.056	0.112	0.066	0.011	0.041	0.215	0.086	**1.000**	0.275	0.428
Livestock	0.197	0.135	0.268	0.077	0.078	0.179	0.316	0.275	**1.000**	0.071
Total planted area	0.010	0.032	-0.036	0.043	0.028	0.204	0.049	0.428	0.071	**1.000**
Soy planted	-0.032	0.033	0.078	-0.090	-0.102	-0.120	0.012	-0.135	-0.187	-0.255
Ln agriculture expenditure	0.045	0.396	0.143	0.097	0.212	0.319	0.137	0.162	0.210	0.123
Ln public safety expenditure	0.092	0.410	-0.010	0.134	0.224	0.351	0.096	0.102	0.053	0.147
Ln housing and urbanism expenditure	0.028	0.544	-0.048	0.097	0.212	0.444	0.119	0.180	0.165	0.204
Without IPTU's collection	-0.021	-0.098	-0.072	-0.082	-0.094	-0.099	-0.019	-0.069	-0.144	-0.073
ISS incentive	0.085	0.089	-0.012	0.035	0.067	0.154	0.038	0.172	0.093	0.192
Fee incentive	0.008	0.143	0.004	0.065	0.121	0.166	-0.012	0.127	0.064	0.134
NPOEAP	0.030	0.348	0.070	0.105	0.100	0.350	0.016	0.099	0.171	0.082
Environmental conscientious firm	0.053	0.143	0.005	0.035	0.027	0.010	0.026	-0.010	0.001	-0.030
The 2004 election	-0.066	-0.083	-0.014	-0.083	-0.112	-0.055	-0.005	-0.022	0.007	-0.015
The 2008 election	-0.060	0.061	0.015	0.000	-0.010	-0.041	-0.121	0.005	0.009	-0.009

The 2012 election	0.125	0.023	0.000	0.080	0.116	0.199	-0.125	0.012	0.036	0.022		

Table M1 – Correlation Matrix – Part C

	Soy planted	**Ln agriculture expenditure**	**Ln public safety expenditure**	**Ln housing and urbanism expenditure**	**Without IPTU' s collection**	**ISS incentive**	**Fee incentive**	**NPOEAP**	**Environmental conscientious firm**	**The 2004 election**	**The 2008 election**	**The 2012 election**
Agribusiness mayor	0.123	-0.031	-0.061	-0.048	0.051	-0.022	-0.025	-0.011	0.039	0.080	0.047	0.009
Female mayor	-0.036	-0.021	-0.029	-0.019	-0.051	0.000	0.016	0.013	0.008	-0.014	0.004	0.064
Full elementary school	0.044	-0.072	-0.048	-0.090	-0.005	-0.026	-0.028	-0.036	-0.001	0.055	0.017	-0.022
High School	-0.016	0.007	-0.017	-0.030	-0.045	0.015	0.012	0.000	0.010	0.029	0.054	0.043
Superior education	-0.092	0.058	0.076	0.110	-0.080	0.015	0.014	0.066	0.033	0.005	0.025	0.066
PSDB (Brazilian Social Democracy Party)	0.223	-0.021	-0.076	-0.034	0.095	-0.024	-0.013	-0.023	0.072	0.019	-0.052	-0.042
DEM (Liberal Party)	0.079	-0.008	-0.048	-0.019	0.005	0.011	0.023	-0.016	0.068	-0.090	0.185	0.022
MDB	0.272	-0.013	-0.063	-0.023	0.078	-0.012	-0.018	-0.016	0.099	-0.046	0.030	0.053
Employee	-0.048	0.029	0.070	0.072	0.013	-0.012	-0.025	-0.006	0.020	0.034	0.030	-0.062
Unemployment insurance	-0.017	0.051	0.015	0.039	-0.031	0.071	0.044	0.019	0.030	-0.075	-0.069	0.143
Work card issued	-0.032	0.045	0.092	0.028	-0.021	0.085	0.008	0.030	0.053	-0.066	-0.060	0.125
Vaccines	0.033	0.396	0.410	0.544	-0.098	0.089	0.143	0.348	0.143	-0.083	0.061	0.023
Coffee dependency	0.078	0.143	-0.010	-0.048	-0.072	-0.012	0.004	0.070	0.005	-0.014	0.015	0.000
Environmental zoning legislation -Law 121	-0.090	0.097	0.134	0.097	-0.082	0.035	0.065	0.105	0.035	-0.083	0.000	0.080
Environmental impact analysis legislation – Law 211	-0.102	0.212	0.224	0.212	-0.094	0.067	0.121	0.100	0.027	-0.112	-0.010	0.116
Number of new firms	-0.120	0.319	0.351	0.444	-0.099	0.154	0.166	0.350	0.010	-0.055	-0.041	0.199
Deforestation	0.012	0.137	0.096	0.119	-0.019	0.038	-0.012	0.016	0.026	-0.005	-0.121	-0.125
Total Herd	-0.135	0.162	0.102	0.180	-0.069	0.172	0.127	0.099	-0.010	-0.022	0.005	0.012
Livestock	-0.187	0.210	0.053	0.165	-0.144	0.093	0.064	0.171	0.001	0.007	0.009	0.036
Total planted area	-0.255	0.123	0.147	0.204	-0.073	0.192	0.134	0.082	-0.030	-0.015	-0.009	0.022
Soy planted	**1.000**	-0.061	-0.141	-0.073	0.370	-0.067	-0.014	-0.067	0.138	0.091	0.089	0.104
Ln agriculture expenditure	-0.061	**1.000**	0.414	0.424	-0.071	0.096	0.161	0.250	0.035	-0.188	0.119	0.070
Ln public safety expenditure	-0.141	0.414	**1.000**	0.633	-0.070	0.110	0.155	0.315	0.010	-0.122	0.012	0.109
Ln housing and urbanism expenditure	-0.073	0.424	0.633	**1.000**	-0.055	0.146	0.148	0.362	0.038	-0.180	0.064	0.117
Without IPTU's collection	0.370	-0.071	-0.070	-0.055	**1.000**	-0.012	-0.049	-0.036	0.005	0.029	-0.074	-0.102
ISS incentive	-0.067	0.096	0.110	0.146	-0.012	**1.000**	0.360	0.111	-0.015	-0.076	0.041	0.036
Fee incentive	-0.014	0.161	0.155	0.148	-0.049	0.360	**1.000**	0.064	0.071	-0.119	0.014	0.104
NPOEAP	-0.067	0.250	0.315	0.362	-0.036	0.111	0.064	**1.000**	-0.003	0.010	0.027	0.005

Environmental conscientious firm	0.138	0.035	0.010	0.038	0.005	-0.015	0.071	-0.003	**1.000**	-0.025	0.020	0.048
The 2004 election	0.091	-0.188	-0.122	-0.180	0.029	-0.076	-0.119	0.010	-0.025	**1.000**	-0.216	-0.226
The 2008 election	0.089	0.119	0.012	0.064	-0.074	0.041	0.014	0.027	0.020	-0.216	**1.000**	-0.218
The 2012 election	0.104	0.070	0.109	0.117	-0.102	0.036	0.104	0.005	0.048	-0.226	-0.218	**1.000**