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► **To cite this version:**

| Manegdo Ulrich Doamba. Political cycles of forest rents in developing countries. 2024. hal-04346755

HAL Id: hal-04346755

<https://univ-orleans.hal.science/hal-04346755v1>

Preprint submitted on 7 Sep 2024

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Political cycles of forest rents in developing countries

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September 7, 2024

Abstract

In this article, we question the presence of electoral cycles in forest rents in developing countries. The presence of rents can be an additional motivation to stay in power as the incumbent can use them to finance elections without running a deficit or increasing taxes. Forest rents are particularly interesting to study in the context of climate change and the fact that forests' point resource characteristics make them more subject to political cycles. Our study covers eighty-three (83) developing countries from 1990 to 2018, using the method of ordinary least squares corrected for the possible Nickell's bias. The results show that cycles in forest rents only appear when the elections' competitiveness is considered. This presence of cycles is robust enough to use different robustness tests. Moreover, the cycles appear only in the event of representation of the candidate in power at the elections and in low-corrupted and high-human-freedom countries.

Keywords: Political cycles, Forest rents, Panel data, Developing countries.

JEL codes: C23, D72, E62, O13, O50, Q3

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1 Introduction

Good institutions are essential for a country's sustainable development, especially in the context of climate change. However, in many developing countries, these institutions need to be improved. The same goes for democracy, which still is a luxury for most developing countries because of the difficulty of implementing and maintaining it. This situation can be explained by the absence of a democratic tradition and other structural factors such as the mobilization of the masses based on identity (manipulation of these masses on ethnic bases) (Rodrik, 2016). Another explanation of this situation in many developing countries is the consequences of natural resource exploitation.

The resources, and the forest resources in particular, constitute an essential source of financing for the economies of these countries. For example, Huang *et al.* (2020) shows that forest rents significantly contributed to the growth of developing countries in Asia between 1996 and 2016. In the same framework, Venables (2016) showed that among the 51 resource-rich countries in the world, 20 derive at least half of government revenue from resource rents. Furthermore, a more significant proportion of these countries, including developing countries, depend on these rents commercially.

Economic literature has pointed out an interaction between natural resources exploitation and institutional quality through natural resources curse theory (Auty *et al.*, 1998; Sachs *et al.*, 1995). Indeed, according to this theory, countries exploiting natural resources economically underperform for several reasons, among which is institutional quality deterioration. So, revenues from natural resources interact with the institutional and political sphere, as can be read in the literature about natural resources rents' political-budgetary cycles.

According to the literature on rents' political-fiscal cycles, rents are used formally or informally to finance the incumbent's re-election. These forest rents can be diverted from their primary role of financing development to financing re-elections. Indeed, the manipulation of elections is quite commonplace in developing countries. Politicians use natural resource rents to stay in power. Economic literature reports on these political

manipulations, and this is what we find in the works of Nordhaus (1975), Rogoff et Sibert (1988), and Shi et Svensson (2006). The manipulations are due not only to the voters' solid preferences for physical well-being and high economic performance (Paldam, 2004; Franzese Jr, 2002), but also to the asymmetric information between voters and incumbent politicians such that voters are not entirely able to distinguish pre-electoral manipulations from incumbent competence (Shi et Svensson, 2006).

Moreover, this motivation to remain in power is more significant in the presence of natural resources. The presence of rents alters the conditions of the game since the incumbent has an extra string to his bow to fund spending to appease voters or secure the favor of the ruling class. Indeed, although voters have solid preferences for physical well-being and high economic performance, they can punish the candidate in the presence of a huge deficit or the event of a tax increase (Huntington, 1993). Thus, rents are a means for the incumbent to finance his re-election. They are a way to finance re-election without incurring the wrath of voters who do not see them as lost revenue, as in the case of taxes used for re-election purposes. In this logic, McGuirk (2013) and Bornhorst *et al.* (2009) point out that rents represent a loosening fiscal constraint on the incumbent. In countries with shallow institutional quality, rents can be used not to motivate voters but to secure the ruling class's support. This mechanism is part of rent-seeking behavior. In this case, rents could fall or increase in the run-up to an election, depending on how they are used. In the case of deficient institutional quality, negative cycles may be observed as rents are diverted to secure the favors of the ruling class. This diversion is done through bribes, as demonstrated by Uberti *et al.* (2019). There can be positive cycles if elections are competitive due to good institutional quality.

The literature on natural resources curse and rents' political-budgetary cycles have significant implications for developing countries. Indeed, weak institutions characterize these countries. The absence of accurate checks and balances and long-term economic reforms characterizes the political landscape. Thus, the various theories of fiscal-political cycles assume the quality of institutions and the presence of free and

competitive elections. These assumptions are problematic because of the institutional weakness and non-competitiveness of elections in developing countries.

The present work fills a gap in the literature on electoral cycles in natural resource rents in developing countries. First, models developed to explain the presence of political-fiscal cycles implicitly assume the presence of regular and competitive elections (Nordhaus, 1975; Rogoff et Sibert, 1988; Shi et Svensson, 2006). For instance, Block (2001) shows that the political cycles are higher in developing countries with competitive elections. However, even in uncompetitive elections, we can observe political cycles at the level of rents. Indeed, the need to finance additional expenditures, acquire an electoral base, or ensure the support of partners requires the mobilization of resources, which is facilitated by the presence of rents in natural resources. The incumbent could use the rents, and in this case, forest rents, to finance his re-election, which is no longer guaranteed in advance given the high level of electoral competition, or to ensure the loyalty of its employees even if there is no competition.

Also, the literature places minimal emphasis on forest resources, particularly in developing countries ¹, and this is a contribution of this paper to the literature. The interest of a study centered on forest rents lies in the fact that this directly impacts deforestation. Therefore, political cycles in rents can have environmental implications, particularly in developing countries that are more affected by climate change. Forest rents are easily manipulated due to the non-necessity of prospecting before exploitation. Thus, developing countries' governments can more easily grant logging permits on the eve of the elections. This paper aims to shed light on these possible cycles through a macroeconomic study of developing countries. Following the literature, in our study, forest rents should increase during competitive elections, but due to rent-seeking behavior, uncompetitive elections could give rise to negative cycles. Through this study, we perform a wide range of robustness and especially heterogeneity tests to better understand these countries' cycles.

¹Authors like Klomp et de Haan (2016) mention this when analyzing the heterogeneity of their results.

We use a dynamic panel model on developing countries using the method of least squares corrected for the bias of [Nickell \(1981\)](#). The results suggest that, in general, we do not have forest rents' political cycles in developing countries, but these cycles appear when considering elections' level of competition. Competitive elections give rise to positive cycles in forest rents, while uncompetitive elections give rise to negative cycles. These results align with the literature that assumes that the presence of competitive elections leads to political cycles. These results are robust to our various robustness tests. Our results have also shown that, as expected from the literature, they only appear if the candidate in power is represented in the elections in low-corrupted countries and countries with high human freedom.

The rest of the paper is presented as follows: in [Section 2](#), we review the literature relevant to our analysis. First, the one dealing with political-budgetary cycles, then the one dealing with natural resource rents and, more specifically, rent-seeking behavior for re-election purposes. [Section 3](#) presents the data we used to carry out our study, descriptive statistics, and stylized facts. The methodology used in the paper will be more fully described in [Section 4](#) of our work. This section contains the model to be estimated and our chosen estimation methodology. Our results will then be presented in [Section 5](#), the robustness and heterogeneity of which will be presented in [Section 6](#) and [Section 7](#), respectively.

2 Political cycles and forest rents: An overview of the literature

This work aims to study forest rents' political cycles in developing countries. We relate the literature on political-budgetary cycles to the literature on the effect of natural resources, particularly forest resources, on the political sphere. Thus, we first study literature dealing with political-budgetary cycles. Secondly, we study literature on the interaction of natural resources (specifically forest resources) with the political sphere.

2.1 Political and budgetary cycles in developing countries

A political budget cycle is a cycle in specific government budget components induced by electoral cycles. Put another way; it is an increase in public spending or deficit or a decrease in taxation in an election year, the objective of which is to favor the incumbent's re-election. There are two explanations for these cycles, which are often contradictory. The first explanation is that the incumbent may change government spending, the deficit, or taxation to please voters who prefer low or high government spending. However, this explanation is difficult to reconcile with voter rationality. Indeed, a rational voter would understand the manipulations of the outgoing candidate and will not be deceived in this case. The second explanation is that voters prefer good economic conditions (such as low unemployment or economic growth) and would be more likely to vote for the incumbent who would provide them with that.

Regarding the theoretical literature on the subject, [Nordhaus \(1975\)](#) and [MacRae \(1977\)](#) are the first articles to address the issue of political-budgetary cycles specifically. They model the occurrence of political-fiscal cycles. According to them, the incumbent will create inflation to take advantage of the relative advantage offered by the Philips curve in the short term² compared with the long term. However, these adaptive expectations models were revisited to consider rational expectations. Following these articles and pioneering models, [Rogoff et Sibert \(1988\)](#) present a model where the government tries to send signals of its competence to the population. The authors argue that the electoral cycles of some macroeconomic variables are due to a temporal informational asymmetry. A voter cannot observe the candidate's competence. The main conclusions of the models described above can be found in the basic model of [Rogoff \(1990\)](#). The major criticism of the above models is that we deal with results models, meaning politicians can finely manipulate macroeconomic aggregates. Recent literature, therefore, emphasizes cycles involving economic policy instruments such as public

²The Phillips curve works on the principle of monetary illusion or nominal illusions. Employers reason for real wages, while employees reason in nominal terms. Thus, inflation in the short run reduces unemployment since employers will hire if inflation is higher than nominal wage growth. Also, this inflation increases consumption by increasing nominal wages.

expenditure. [Shi et Svensson \(2006\)](#) develop a model using a moral hazard model to explain political cycles measured by cycles in a policy instrument (the budget). In this model, the magnitude of a budgetary election cycle depends on the politician's motivation to stay in power and the share of voters unaware of the politician's manipulative objectives.

As highlighted in the literature, the informational asymmetry can explain the presence of a political cycle. This informational asymmetry may correspond to the age of democracy, in which case voters do not have the necessary hindsight to understand the maneuvers of the politician in power or to access information. The experience of the electorate plays an essential role in its capacity to understand the manipulations, as underlined by [Brender et Drazen \(2005\)](#). The informational asymmetry may also correspond to access to information. Indeed, the lack or non-access to information on the management of natural resources or the candidate's motivations in power means that the leader can easily take advantage of it to find additional funds to ensure his re-election ([Brender, 2003](#); [Shi et Svensson, 2006](#)).

[Tufte \(1978\)](#) first empirically tested the theory of budgetary-political cycles in the specific case of the United States of America. However, a panoply of articles followed this first one. One of the most recent papers in this field concerning African countries is that of [Iddrisu et Bokpin \(2018\)](#). A very recent paper by [Boly et al. \(2023\)](#) shows the presence of political cycles in CO2 emissions, demonstrating the environmental effects of electoral cycles; and this last paper is fascinating to us because.

Some articles highlight cycles in developing countries ([Block et al., 2003](#); [Mosley et Chiripanhura, 2016](#)). However, applying the theory of political-fiscal cycles to developing countries raises questions. Indeed, the usual theories are based on a certain institutional quality that guarantees free and competitive elections. We must break down these assumptions to test these theories in developing countries. We will directly impact the model's predictions by questioning this given level of institutions, as authors such as [Schultz \(1995\)](#) and [Block \(2002\)](#) point out.

Several components of the state budget are subject to political-budgetary cycles. Forest rents constitute a means for the candidate for power to finance his re-election. The literature highlights the advantage of natural resource rents to the incumbent (Smith, 2004; Goldberg *et al.*, 2008; Aaskoven, 2020).

2.2 Forest rents and their interaction with the political sphere

The abundance of natural resources should be a blessing for countries. However, in many cases, the abundance, especially the exploitation of these resources, has harmed countries. This contradictory effect of the abundance of natural resources can be explained by the curse of natural resources (Sachs et Warner, 2001). According to the authors, the discovery of resources leads to a fall in income due to a rise in the real exchange rate (Corden et Neary, 1982). Collier (2010) shows an interaction between the endowment of natural resources and the quality of institutions. When asked why natural resource endowments worsen the political situation in developing countries, one of the author's arguments is the lack of accountability of leaders to the population. Indeed, the abundance of natural resources creates a decline in institutional quality, which in turn creates a decline in economic growth (Leite et Weidmann, 1999). Other papers like Sala-i Martin et Subramanian (2013) and Isham *et al.* (2005) show that natural resources negatively impact economic activity when good institutions are not set up.

Forest resources are point resources. Unlike diffuse resources, point resources are spatially concentrated and can easily be controlled (Bulte *et al.*, 2005). Hence, point resources are those that hurt institutions. These are, for example, oil resources, minerals, and plantations. The political sphere could be affected by the harmful effects of the abundance of natural and forest resources, which are point resources.

Significant revenues from natural resources have two effects on the incentives of political actors. First, the incumbent will have a greater incentive to stay in power. This could lead to political-fiscal cycles. He can, therefore, use the rent to ensure his

re-election, either by currying favor with the electorate if the competition is great or by securing the ruling class's support if not. Second, other candidates will be more motivated to run for office, thus increasing electoral competition. In this case, the incumbent will do everything he can to win over the electorate.

In practical terms, large amounts of forest resources in a country affect the politicians' behavior: The politicians will have more motivation to stay in power, while other candidates will be motivated to run for office. Following this logic, leaders could increase or divert rents before elections to curry favor with the ruling class through a symbolic exchange system ([Médard, 1991](#)) or with the electorate through increasing public expenditure. Indeed, the incumbent must have as much support as possible to safeguard power. A rentier state sees its obligations of transparency and accountability to the population diminished since rents sometimes replace the existing tax system. Thus, rents lead, in the long run, to a situation where the population demands a minor change in a political regime ([Beblawi et Luciani, 2015](#)).

[Aaskoven \(2020\)](#) shows that natural resource rents to finance re-election can be obtained in two ways: directly by increasing revenues from the mining industry and national mining companies. However, in the case of African countries, most mining companies are private, and therefore, the state will go through taxation to increase its revenues from natural resources. Alternatively, in countries with low institutional quality, private companies may allow rent diversion to finance the incumbent's re-election in exchange for post-election contracts. Another more specific study [Uberti et al. \(2019\)](#) shows that governments can also go through unofficial channels to take advantage of the manna offered by natural resource rents to finance the incumbent's re-election. The candidate can increase production by increasing operating licenses instead of increasing taxation in the mining sector during an election period. He can also use the licenses to curry favor with the country's ruling class. According to the literature, the punctual or diffuse nature of the natural resource can impact its interaction with the political sphere. Concerning forest resources, it should be noted that unlike other

resources, which require several studies and several years before their exploitation, they are more easily exploitable. Such a situation favors policies aimed at increasing the rent before the elections.

From all the above, we see that only some studies focus on forest rents. Next, most of the articles conduct studies on political cycles from countries with a high level of electoral competition, thus excluding a good number of developing countries. In this study, we propose to investigate the presence of political cycles at the level of forest rents in developing countries by considering the level of electoral competitiveness. Therefore, we will test a set of hypotheses that allow us to shed light on the cycles in natural resource rents.

Political cycles in natural resource rents depend on the level of election competition. Overall, at the level of developing countries, we do not expect to detect positive electoral cycles in forest rents. However, considering electoral competition, we will not be surprised to see rent movements on the eve of the elections. A higher level of electoral competition may force the incumbent to use these rents to ensure he remains in power.

3 Data and Descriptive Statistics

In this section, we first present variables used in this study and their sources in Subsection 3.1, and then present descriptive statistics for our variables in Subsection 3.2.

3.1 Definition of variables

The final sample comprises eighty-three (83) rentier and not-rentier developing countries. The list of countries included in the analysis is in the Appendix (Table 6). Depending on data availability, we looked for electoral cycles in these countries from 1990 to 2018. The choice of developing countries is motivated by the will to include developing countries, most often absent from this analysis. Then, for robustness, we will limit

the sample to rentier countries to see if the cycles are more pronounced.

The measurement of forest rents: *Forest_rent*

The measure we use is the one introduced by [Collier et Hoeffler \(2009\)](#) that considers the fluctuation of world prices and extraction costs. The World Bank published the data for this new measure of rents ([Lange et al., 2018](#)). Its construction consists of several steps: The first consists of defining rent as the difference between the world price of resources and their extraction costs. The second step consists of multiplying this unit rent by the extracted volume. Then, each year, this product is divided by the GDP of the year concerned. This dependent variable of natural resources has advantages, such as disaggregating it into different types of resources. So, this global database gives the rents for different resources, and we will focus on the forest rents according to the objective of this analysis. This variable does not directly measure the share of rents going to the state accounts but is a good approximation. [Klomp et de Haan \(2016\)](#) showed a significant and robust correlation between the level of rents and state income from rents.

The variable of interest: *Elect*

Our variable of interest is the election period. In the previous literature dealing with issues of fiscal-political cycles, the variable used to capture the election period is a dummy variable, taking the value of 1 in election years and 0 in other years. [Franzese \(2000\)](#) proposed an alternative measure to this discrete measure. The proposed measure is a measure whose sum gives one, and this unit is split between the year of the election and the year before the election. Practically, [Franzese \(2000\)](#) creates the variable $elect_t$ for the election in year t , which is equal to $(M/12) + (d/D)/12$ the year of the election with M the number of whole months before the election, d the number of whole days in the month before the election and finally D the number of whole days in the year. In the year before the election, this variable is equal to $1 - ((M/12) + (d/D)/12)$. [Klomp et de Haan \(2016\)](#) used the simplified version of this variable. In the latter

case, both authors defined their variable as $M/12$ in the election year and $(12 - M)/12$ in the year before the election. This variable allows for capturing the election period more accurately because it captures the electoral period more precisely. Indeed, let us imagine that the election was on February 1, 2000. The standard measure would have taken discrete and taken the whole year 2000 as the election year, while the campaign mainly took place in 1999. This *Elect* variable includes the elections that took place at the scheduled times and those that were delayed. Referring to the literature, when not considering the level of election competition, we expect to see either a positive and significant sign or non-significance for this variable, but not a negative and significant one.

Considering the competition level: $Elect \times Con$

As mentioned above, some papers, such as [Schultz \(1995\)](#); [Block \(2002\)](#), questioned the assumptions made by the models explaining the political and budgetary cycles. As our study concerns developing countries, which are not all democratic, it is necessary to consider the level of competitiveness of elections. In this way, the electoral variable will be weighted by an index, giving the level of political constraint. The political constraint variable comes from the database developed by [Henisz \(2005\)](#). The weighting makes it possible to retain the most significant number of elections, which makes it possible to have more observations with a non-zero election period. Second, weighting allows us to maintain the most significant variability within our variable, whereas excluding non-competitive elections would cause us to lose this variability. Finally, it avoids the exclusion of non-competitive elections. The exclusion of non-competitive elections must be done based on a threshold, and this threshold would be done on an arbitrary basis, which we avoid using the weighting method.

[Henisz \(2005\)](#) developed the POLCON database to consider the feasibility of policy change on the part of the government. In other words, how the change in the point of view of one of the actors affects the country's politics. This initial measure was improved to consider the heterogeneity within the main political parties. The author

shows that homogeneity within the united opposition party was a sign of significant political constraint. This variable can, therefore, be used as a proxy for competition and the quality of elections. Indeed, it measures the existing counter-power. Robust checks and balances mean that the president in power must prove himself to stay in power and can, therefore, be ejected at the end of his term, which makes elections more competitive. Considering the election competition level, we expect a positive and significant sign for the *Elect_Con* variable. Other measures of political competition include the vote share of political parties or the number of political parties running for office. However, given the recurrent electoral fraud in many countries in our sample, using such measures would give highly biased results.

This interactive is essential since it considers the level of electoral competition. However, we may face a potential endogeneity problem due to the inverse causality between the level of electoral competition and rent. To tackle this problem, we use the Generalized Method of Moments (GMM) with lagged values of the level of electoral competition as instruments for a robustness test. This methodology enables us to deal with the endogeneity arising from the dynamic specification and reverse causality.

Control variables

We first include institutional variables such as the level of corruption (*Corruption*) and level of democracy (*Democ*) of the country as control variables. Indeed, according to the literature, the institutional factor is essential in determining a given country's rent level, and natural resource rents are also a key determinant of the institutional quality (Mehlum *et al.*, 2006). It is, therefore, necessary to include this factor in our analyses.

We also included the GDP per capita (*GDP*) level to consider the development level. The empirical literature underlines the role of economic development on the occurrence or magnitude of political-fiscal cycles. Already, the literature points out that such cycles are more likely to occur in the least developed countries. Several

factors can explain this result. According to [Shi et Svensson \(2006\)](#), this is mainly due to differences in the institutional environment, while [Brender et Drazen \(2005\)](#) points to the weak democratic experience of low-income countries.

The third control variable is the depletion rate of natural resources (*Depl*). This variable has been used in the literature as a proxy for the level of natural resource rents globally. We use this variable instead of the total rent variable because it is mechanically linked to the level of forest resource rents, which is only one component. This variable of the rate of depletion of natural resources has the role of taking into account the country's mining activity. It shows the pressure on forest rents since the more other natural resources are depleted, the more countries will be tempted to turn to forest resources. Although calculated based on unit rents, the depletion rate only considers the excess of rents over natural growth³. It, therefore, takes into account the endowment of natural resources, which reflects a country's wealth in natural resources.

The last control variable is the urbanization rate (*UrbanPop*), which considers the part of the population that is subject to manipulations to the cycles. Indeed, in developing countries, the urban population is the most educated and able to understand the political programs of the various candidates. The urban population, therefore, impacts political cycles because, in developing countries, a large proportion of the urban population is the best-informed and has their finger on the political pulse. Rural populations are usually disconnected from the rest of the country and are poorly served by the public infrastructures.

3.2 Descriptive Statistics

This section on descriptive statistics describes the variables over the entire study period. We are working on 83 developing countries from 1990 to 2018.

Graph 1 shows the level of forest rents for the first year of our study period. It shows

³<https://databank.worldbank.org/metadataglossary/world-development-indicators/series/NY.ADJ.DRES.GN.ZS>

that most of the countries in our sample have forest rents. Central African countries depend highly on forest rents, which is only logical given their forest resources. The countries of Latin America, on the other hand, although rich in forest resources, are not heavily dependent on these rents.

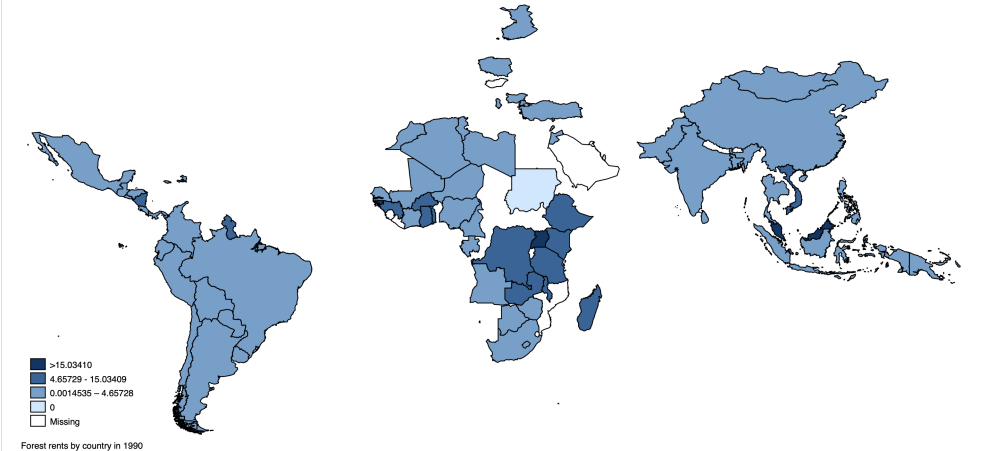


Figure 1: Forest Rents in 1990 for countries in our sample
Sources: World Development Indicators

Table 1: Descriptive Statistics

Variable	N	Mean	SD	SE	Min	Max	Measurement unity
Forest_rent	2368	3.0044	4.9857	0.1025	0.0000	36.0683	% of GDP
GDPperCap	2345	5045.0717	8613.2618	177.8673	164.3366	16648.7700	Constant Dollar
Democ	2377	3.9348	9.3384	0.1915	0	10	Index (0 to 10)
UrbanPop	2384	51.6228	21.7195	0.4448	11.0760	95.3340	% of Population
Corruption	2338	2.4300	0.9931	0.0205	0	6	Index (0 to 6)
Depl	2287	5.1173	6.8708	0.1437	0.0000	68.5665	% of GNI
Polcon	2218	0.2723	0.2080	0.0044	0.000	0.7256	Index (0 to 1)
Elect	2384	0.1293	0.2840	0.0058	0.000	1.0000	.

After studying the graph 1, we review the main descriptive statistics of our variables, summarized in the table 1. The dependent variable, the level of forest rents, has a mean of 3% of GDP. This means that, on average, in our sample, the countries are endowed with forest resources whereby generating forest rents as shown in graph 1. However, this level of forest rent is highly variable since the standard deviation is significant (4.985),

larger than the average (3.004). Looking at the GDP per capita variable, we notice that our sample is quite heterogeneous and includes developing countries from the least rich to the most rich. Indeed, the standard deviation is far above the average. The same observation applies to the level of democracy. Our sample of 83 countries contains democratic and non-democratic countries, as we can see from the *Democ* variable.

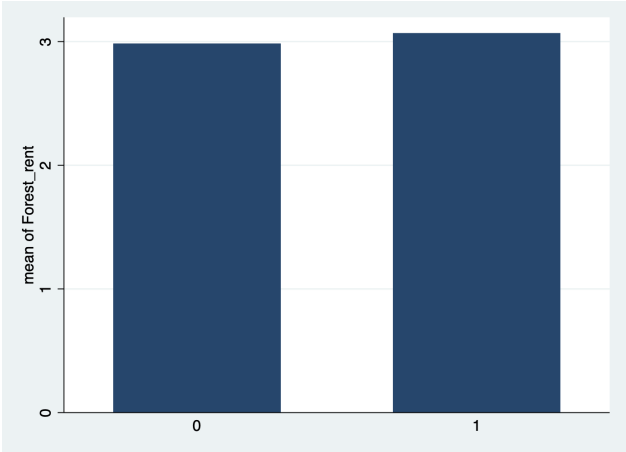


Figure 2: Average rents during electoral and non-electoral periods
Sources: Author calculation, WDI rent database and NELDA database

According to our assumptions, we should not observe a significant increase in forest rents during the election period. This is what we see in the graph 2. Indeed, the difference of rent between electoral and not-electoral period is very slight.

The second key element of our study is to consider the level of competitiveness of the elections. For this purpose, we use the political constraint variable (*POLCON*). Graph 3 shows a negative relationship between the level of political constraint and the level of rents since the slope of the regression line is negative. So, a political constraint is associated with more excellent institutional quality and lower rent dependence.

A final point in favor of our hypotheses is the positive relationship between the level of forest rents and the length of time politicians have been in power, shown by graph 5. This positive relationship between natural resource rents and length of time in power was highlighted by Désiré Omgba (2007).

These initial statistics provide us with a compelling starting point for understanding the intricate relationships between the variables. However, to truly grasp the depth of

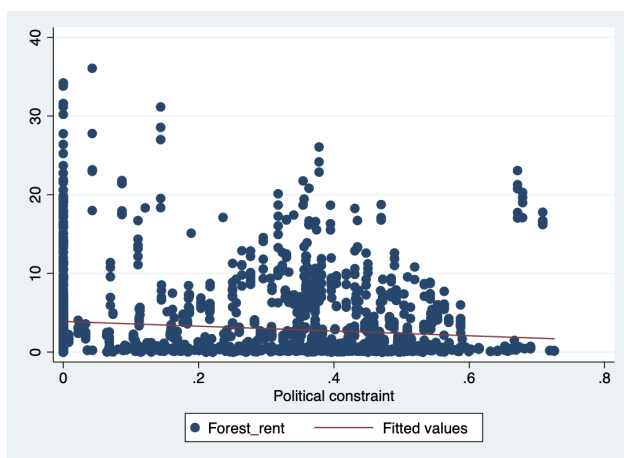


Figure 3: Relationship between Forest rents and Political constraint
 Sources: Author calculation, WDI rent database and POLCON database

these connections, we must delve into a comprehensive set of other interactions. This is the path we will tread with our rigorous econometric approach, promising to unveil significant insights.

4 Econometric framework

We rely on a dynamic specification, which is theoretically interesting because it assumes a steady state value of the forest rent, towards which one country convergences conditionally on the Election variable and other conditioning factors. Furthermore, this is due to the inertia effect of resource rents. However, it makes estimates sensitive to the Nickell' bias (Nickell, 1981). This will lead us to a second part to discuss the choice of the estimator.

4.1 Econometric model

Regarding the econometric specification, we will use two approaches. The first approach will allow us to search for cycles in forest rents in elections, and the second will take into account elections' level of competitiveness. We will, therefore, have the following two equations:

$$Forest_rent_{it} = \omega_i + \delta_t + \theta Forest_rent_{it-1} + \phi Elect_{it} + \psi Z_{it} + v_{it} \quad (1)$$

$$Forest_rent_{it} = \omega_i + \delta_t + \theta Forest_rent_{it-1} + \phi Elect_{it} + \rho Polcon_{it} + \beta Elect \times Con_{it} + \psi Z_{it} + v_{it} \quad (2)$$

In the two equations, the subscripts i and t indicate the country and year involved. $Forest_rent_{it}$ represents the forest rents variable as a percentage of GDP. The variable $Forest_rent_{it-1}$ denotes the lagged value of the dependent variable. As mentioned above, the lag variable is interesting because of the inertia effect of the natural resources rents. A country does not become rentier overnight. Thus, a country with rents in an election year will likely have had rents the year before. Thus, not taking into account lagged values of annuities could lead to an erroneous analysis.

The variable ω_i is the variable that controls for the unobservable characteristics of the different countries in our sample; these are the country-fixed effects. The variable δ_t captures the time-fixed effects, that is, the unobservable characteristics of each year. The variable $Elect_{it}$ refers to our variable indicating the pre-election period. Z_{it} refers to our model's set of control variables. These explanatory variables are supposed to explain the rents received by the different countries partly, and we base ourselves on the literature for the choice of these variables. In equation 2 only, the variable $Polcon_{it}$ refers to our electoral competition variable, and finally, the variable $Elect \times Con_{it}$ is the interaction between our electoral variable $Elect_{it}$ and the variable $Polcon_{it}$.

4.2 The estimation method

The lagged variable in our specification makes the econometric techniques commonly used in the case of panel data inefficient. The Fixed Effects (FE) method is unsuitable for our specification because it would negatively correlate the error term and the lagged endogenous variable. This negative correlation of the fixed effects estimator is known as Nickell's bias (Nickell, 1981).

The standard solution usually used is the Generalized Moment Method (GMM). It

is a method adapted to dynamic panel studies by controlling for the endogeneity of the variables that cause us problems while controlling for country and time-fixed effects. However, this method is challenging to implement because of the many conditions that must be respected for valid results. Conditions ⁴ which are described in detail by [Roodman \(2009\)](#).

The methodology chosen is the ordinary least squares corrected from Nickell’s bias. The idea behind this method is to approximate the bias generated by the estimation with the inappropriate estimators to remove this bias from the estimation of the parameters. This method is based on the work of [Nickell \(1981\)](#). Indeed, in addition to highlighting the inadequacy of Ordinary Least Squares due to the bias, [Nickell \(1981\)](#) tried to approximate this bias. Monte Carlo simulations were performed to obtain the properties of the bias-corrected ordinary least squares estimator. These simulations showed that bias-corrected OLS outperforms the instrumental variable and GMM methods in terms of bias. Work such as [Bun et Kiviet \(2003\)](#) has successfully approximated up to 90% of the bias. In this study, we will use a version of this estimator developed by [Bruno \(2005\)](#), which is adapted to unbalanced and non-cylindrical panels. This methodology is becoming increasingly used in the literature ([Trabelsi, 2016](#); [Gootjes et al., 2021](#); [Debrun et al., 2008](#)), making it possible to perform certain types of studies on groups of countries, which was not possible with the GMM estimators.

In practice, bias-corrected ordinary least squares are obtained in two steps. The first step is to estimate the bias, and the second is to extract the bias from the ordinary least squares estimate. First, three methods described by [Bruno \(2005\)](#), are available for bias estimation. The different bias approximations are: $B_1 = c_1(T^{-1})$, $B_2 = B_1 + c_2(N^1T^{-2})$, $B_3 = B_2 + c_3(N^1T^{-2})$ with N the number of study units and $T = (1/N)sum_1^N T_i$ presents the average panel size of the group. Then, three estimators can be implemented to estimate this bias, depending on the type of bias chosen for the

⁴Indeed, to validate the results following the use of the Generalized Method of Moments, the coefficient of the lagged dependent variable must be significant and less than 1. Then, due to the lagged variable’s presence, we expect an autoregressive process of order 1 (AR(1)). However, there is no reason for an autoregressive process of order 2 (AR(2)). Finally, the instrumental variables must be valid, and this is verified through the Sargan and Hansen test.

correction. It can be estimated either using the [Anderson et Hsiao \(1981\)](#) estimator or the difference estimator of [Arellano et Bond \(1991\)](#), or the system estimator of [Blundell et Bond \(1998\)](#)⁵

5 Results and discussion

The main results in Table 2 consist of three parts. The first two columns of the table (Columns [1-2]) show a univariate regression, considering the electoral variable (*Elect*) as the only explanatory variable but taking care to control for fixed effects. The coefficient in front of the variable *Elect* is not significant. So, these two columns show us that elections generally do not give rise to increases in forest rents. The two following columns (Columns [3-4]) present a more enriched specification than the previous ones since we consider the level of competitiveness of the elections here, as described above. These columns contain three explanatory variables, and the results already confirm our expectations. The coefficient in front of the interactive variable ($Elect \times Con$) is positive and significant. Competitive elections give rise to the manipulation of forest rents for re-election purposes. Columns [5-6] provide the same result as in Columns [1-2], but here we take care to control by critical variables. The last two columns (Columns [7-8]) are the most complete model of our analysis. They allow us to check the robustness of our results shown in Columns [3-4] by controlling for factors that can influence forest rents in a country.

The implications of our research findings are significant. Competitive elections in our sample countries lead to an increase in forest resource rents. The main result, as presented in Column [8] of Table 2, indicates that an increase in the level of competitiveness of the elections results in a corresponding increase in forest rents in the

⁵The Nickell bias-corrected least squares method is not a GMM estimator but uses GMM estimators to estimate Nickell's bias. Once the bias has been estimated, the equation $MCOC_i = MCO - B_i$, $i = 1, 2$, or 3 can now be solved. The error term is obtained by a bootstrap method. In this analysis, we have chosen the most rigorous definition of bias. Furthermore, we estimated our main regressions using the Blundell-Bond estimator. However, our main results are reproduced by following the other two estimators, Arellano-Bond and Handerson-Hsiao. Moreover, we chose 100 bootstraps to calculate the error term.

Table 2: Main Results

	1	2	3	4	5	6	7	8
	OLS	LSDVC	OLS	LSDVC	OLS	LSDVC	OLS	LSDVC
L.Forest_rent	0.6831*** (0.0160)	0.7820*** (0.0157)	0.6531*** (0.0164)	0.7596*** (0.0163)	0.6571*** (0.0167)	0.7546*** (0.0191)	0.6213*** (0.0169)	0.7266*** (0.0210)
Elect	-0.1294 (0.1029)	-0.1304 (0.1273)	-0.3932** (0.1659)	-0.4217** (0.1711)	-0.1525 (0.1057)	-0.1529 (0.1093)	-0.4508*** (0.1721)	-0.4826*** (0.1707)
Elect x Con			0.8616* (0.4672)	0.9465** (0.4534)			0.9409** (0.4784)	1.0350** (0.5005)
Polcon			-0.8726*** (0.2125)	-0.9307*** (0.2626)			-1.0470*** (0.2280)	-1.1070*** (0.2633)
Corruption					-0.1047** (0.0483)	-0.1176** (0.0535)	-0.1412*** (0.0491)	-0.1560*** (0.0559)
GDPperCap					0.0001** (0.0000)	0.0001** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Depl					0.0485*** (0.0086)	0.0450*** (0.0109)	0.0625*** (0.0089)	0.0570*** (0.0109)
UrbanPop					0.0063 (0.0114)	0.0118 (0.0156)	0.0063 (0.0125)	0.0146 (0.0177)
Democ					-0.0058 (0.0040)	-0.0053 (0.0047)	-0.0016 (0.0042)	-0.0011 (0.0044)
<i>N</i>	2285	2298	2119	2119	2180	2180	2010	2010
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
R ²	0.93		0.93		0.94		0.94	
Countries	83	83	83	83	87	87	83	83

Notes: N=2010, t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. We have opted to present the OLS regressions in order to present the R2 of the LSDVC regressions, since technically they are the same regressions, only with the added correction of Nickell's bias. The command does not provide an R2 for LSDVC regressions.

pre-electoral period. This finding underscores the potential impact of political competition on natural resource management.

Although competitive elections are a source of cycles in the countries in our sample, elections, in general, could have surprising results given the institutional quality of the countries studied. Indeed, our results also show that countries with weak political constraints tend to experience declines in forest rents on the eve of elections, as we can see with the negative and significant rent variable in column [8]. Thus, controlling for electoral competition, we find that countries with weak electoral competition experience negative cycles in forest rents.

At the average level of competition in our sample, there tends to be a negative cycle in forest rents, as many countries in our sample have low levels of political competition⁶. However, from the ninetieth percentile onwards, positive cycles tend to appear. This result shows two types of electoral cycles within our sample. Negative cycles highlight informal mechanisms, and positive cycles highlight formal mechanisms. Negative cycles can be explained by the fact that rents are used to secure the support of certain partners, not of the population (Médard, 1991).

In an election with strong competition, the need to finance projects to attract the population's favor leads to positive cycles since government revenues from mining activity are proportional to rents. Thus, to have more income, the government authorizes an increase in logging, leading to an increase in forest rents. On the other hand, the absence of competition leads to negative cycles due to the diversion of income from logging to attract the favor of the ruling class. The rents are under-declared to be diverted to benefit the president's supporters in power since it is easier to use them directly for this corruption than the budget.

There is a great deal of corruption in the logging sector in developing countries. For example, a report by the African Development Bank⁷ highlights the corrupt practices involved in granting logging licenses in Africa. Areas not intended for logging are even

⁶This result is obtained by performing the following calculation: $-0.4826 + 0.2723 \times 1.035 = -0.200$

⁷https://www.afdb.org/sites/default/files/documents/publications/illicit_timber_trade_report.pdf

exploited with the agreement of local authorities. In this way, on the eve of competitive elections, the government, to finance its projects, can increase the number of licenses issued to boost its revenues simultaneously, leading to an increase in rents in the pre-election period. However, when the stakes are not high, increasing government revenues through higher rents is unnecessary. To avoid coups d'état, for example, the incumbent candidate, again due to corruption, uses revenues from forestry resources to win the loyalty of his supporters. In this case, this is done by under-declaring the rents.

In addition to our weighted electoral variable of the level of election competitiveness, our final model (the last two columns) includes other variables that yield intriguing results. The presence of political constraints is associated with lower forest rents, a result that can be attributed to the reduced risk of manipulation of exploitation rights granted to companies. The unexpected finding is the negative relationship between corruption and forest rents. One might expect a positive relationship, but this result underscores the complexity of the relationship between natural resource rents and corruption. High levels of corruption do not always translate to high rents, as these may not be declared in some instances. This is particularly relevant in our case, where we have already controlled for institutional quality through the level of political constraint.

6 Robustness analysis

In this section, we present the robustness of our result when considering the elections' competitiveness, and the results are presented in Tables 3 and 4. We first use the Anderson-Hsiao and Arellano-Bond estimators to estimate bias instead of the Blundell-Bond estimator, followed by other, less stringent bias corrections. Next, we use an alternative estimator: the GMM method. Then, in the third section, we see the magnitude of our results for resource-dependent countries. Finally, we use additional control variables and placebo tests to confirm the robustness of our results.

Table 3: Exploring the robustness 1

	1	2	3	4	5	6
	AH	AB	B1	B2	GMM	Forest_dependent
L.Forest_rent	0.6917*** (0.0217)	0.6726*** (0.0217)	0.7235*** (0.0211)	0.7232*** (0.0209)	0.7740*** (0.0356)	0.6724*** (0.0314)
Elect	-0.4613*** (0.1712)	-0.4550*** (0.1666)	-0.4820*** (0.1706)	-0.4816*** (0.1706)	-0.4443** (0.1755)	-1.0796*** (0.3634)
Elect x Con	0.9793* (0.5024)	0.9559* (0.4897)	1.0333** (0.5002)	1.0322** (0.5002)	0.9780** (0.4880)	2.6876* (1.4295)
Polcon	-1.1156*** (0.2640)	-0.9707*** (0.2544)	-1.1063*** (0.2635)	-1.1053*** (0.2634)	-0.8760*** (0.2352)	-2.9584*** (0.8870)
Corruption	-0.1415*** (0.0545)	-0.1295** (0.0528)	-0.1558*** (0.0560)	-0.1556*** (0.0559)	-0.1313*** (0.0502)	-0.4696*** (0.1514)
GDPperCap	0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	-0.0005** (0.0002)
Depl	0.0497*** (0.0109)	0.0574*** (0.0105)	0.0571*** (0.0109)	0.0571*** (0.0109)	0.0551*** (0.0092)	0.1202*** (0.0223)
UrbanPop	0.0173 (0.0171)	0.0056 (0.0160)	0.0144 (0.0177)	0.0143 (0.0177)	0.0098 (0.0127)	0.0111 (0.0451)
Democ	-0.0008 (0.0045)	-0.0013 (0.0045)	-0.0011 (0.0044)	-0.0011 (0.0044)	-0.0020 (0.0043)	-0.0241 (0.0636)
N	2010	2010	2010	2010	2010	620
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Countries	83	83	83	83	83	25

Notes: N=2010, t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In column 6, the test results related to the GMM estimator are: AR1: -12.28***, AR2: 0.44, Sargan test: 9.83***.

6.1 Use of alternative bias correction.

The command developed by the authors of the model we use allows using several estimators to estimate Nickell's bias to correct the Ordinary Least Square estimator. In the primary model, we use the Blundell-Bond estimator. For robustness, we use the other estimators available in the command, namely the Anderson-Hsiao estimator and the Arellano-Bond estimator. The results are presented in the first two columns (Columns [1-2]) of Table 3. We see that these two results support our findings. Furthermore, the coefficients are qualitatively and substantially similar: Competitive elections lead to cycles in forest rents.

We also test the robustness of our results by using different levels of bias to estimate our results. As specified above, Nickell's bias can be corrected according to three possible estimates of this bias. The one we used in our primary model is the most restrictive possible. Columns [3-4] of Table 3 present the results for the other two bias estimates. Again, our results are confirmed, and the coefficients are qualitatively equal to those in our main results.

6.2 Use of GMM method.

Among the possible methods we could choose to estimate our dynamic panel model is the Generalized Method of Moments (GMM). However, we had chosen the generalized least squares corrected for Nickell's bias. In this part, we propose to re-estimate our primary model using GMM. This method is commonly used to estimate dynamic models because it solves endogeneity issues. Indeed, the presence of the lagged explained variable creates an endogeneity problem. Also, as specified above, there can be a double causality between the level of electoral competition and rent. Indeed, electoral competition can lead to an increase in rents in order to finance development projects. Also, high rents lead to increased electoral competition to monopolize these rents. This double causality results in a potential endogeneity issue, which can also be corrected using the GMM method. The results, presented in the Column [5] of Table 3, are robust

to this alternative method. Furthermore, as in the other robustness tests, the coefficient is substantially equal to that of the main results.

6.3 Countries dependent on forest rents.

Our study takes into account developing countries without taking into account their level of dependence on forest resources. In this section, we intend to test the validity of our results by only retaining our sample countries that are highly dependent on forest resources. We constructed a sub-sample of countries with forest rents above the average. The results, presented in the Column [6] of Table 3, show once again that our obtained results are robust and, even more, qualitatively similar.

6.4 Use of additional control variables.

In this test, we add new control variables to show that our specification is stable and robust. We are introducing several control variables likely to impact the level of forest rents, particularly during an election period. The first variable we introduce is the level of internal conflict within each country (*InternalConflict*). This additional variable makes it possible to consider general and political instability. This instability can impact the quality of the elections that must be held. The second variable that we incorporate for robustness is the level of socioeconomic conditions of the population (*SocioeconomicConditions*). We get this variable from the ICRG database. The socioeconomic conditions of a population can make it remarkably docile to manipulation during an election period. The last variable this robustness test includes is the exchange rate (*Exrate*). Our results are presented in the three first columns (Columns [1-3]) of Table 4 and are still robust to these robustness tests.

6.5 Placebo tests

In this section, we perform placebo tests. For this, we have made shifts in the election dates to demonstrate that the cycles detected above do not appear during non-

Table 4: Exploring the robustness 2

	1	2	3	4	5	6	7
	Conflict	Social	Exrate	Before	One year	Two year	Three years
L.Forest_rent	0.7274*** (0.0210)	0.7263*** (0.0211)	0.7278*** (0.0194)	0.7272*** (0.0208)	0.7267*** (0.0210)	0.7264*** (0.0209)	0.7275*** (0.0209)
Elect	-0.4954*** (0.1695)	-0.4817*** (0.1703)	-0.4854** (0.1973)				
Elect x Con	1.0620** (0.4981)	1.0285** (0.4993)	0.9868* (0.5682)				
Polcon	-1.0737*** (0.2642)	-1.1201*** (0.2629)	-1.0865*** (0.2809)	-0.9853*** (0.2647)	-1.0271*** (0.2651)	-1.0504*** (0.2529)	-0.9234*** (0.2630)
Corruption	-0.1473** (0.0574)	-0.1555*** (0.0559)	-0.1593*** (0.0582)	-0.1558*** (0.0562)	-0.1557*** (0.0561)	-0.1568*** (0.0562)	-0.1557*** (0.0559)
GDPperCap	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Depl	0.0572*** (0.0109)	0.0567*** (0.0109)	0.0561*** (0.0105)	0.0571*** (0.0108)	0.0572*** (0.0109)	0.0573*** (0.0107)	0.0568*** (0.0109)
UrbanPop	0.0145 (0.0177)	0.0154 (0.0179)	0.0165 (0.0179)	0.0150 (0.0178)	0.0153 (0.0177)	0.0153 (0.0177)	0.0151 (0.0178)
Democ	-0.0020 (0.0045)	-0.0009 (0.0044)	0.0010 (0.0046)	-0.0002 (0.0044)	-0.0003 (0.0044)	-0.0001 (0.0044)	-0.0003 (0.0044)
InternalConflict	-0.0432* (0.0244)						
SocioeconomicConditions		-0.0248 (0.0436)					
Exrate			0.0000** (0.0000)				
Before_elect				0.0003 (0.2040)			
Before_Con				0.1411 (0.5921)			
Elect1					-0.1540 (0.2028)		
Elect_Con1					0.4272 (0.5901)		
Elect2						-0.1092 (0.1975)	
Elect_Con2						0.5088 (0.5208)	
Elect3							0.1017 (0.1641)
Elect_Con3							-0.2293 (0.4981)
N	2010	2010	1971	2010	2010	2010	2010
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Countries	83	83	83	83	83	83	83

Notes: N=2010, t statistics in parentheses

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

election periods. Indeed, the appearance of electoral cycles can be attributed to other cycles, such as cycles of corruption that occur during the same period. Therefore, we must ensure that the cycles captured are electoral cycles that only appear during the electoral period. In our exercise, we tried to detect cycles in the years following the elections. We have placed the election years as the one, two, and three years after the elections. Results are presented in the four last columns (Columns [4-7]) of Table 4. Moreover, in line with our expectations, we do not find cycles in forest rents during non-electoral periods. This result confirms our findings and constitutes the last series of robustness tests we implement.

7 Heterogeneity analysis

As mentioned above, our results are supposed to have a high degree of heterogeneity. We propose to test this, and the results are presented in Table 5. Firstly, we will look at how results vary according to whether or not the elections are early and whether the incumbent candidate is represented in the elections. In addition, factors such as the level of corruption and individual freedoms may influence our results. We, therefore, also analyze the sensitivity of our results to these two factors.

7.1 The difference between staggered elections and regular elections

According to the literature (Uberti *et al.*, 2019), early elections do not allow the candidate in power to manipulate public opinion since the deadline would be too short. This is what we propose to test in this part. The database allows us to divide the elections depending on whether the elections are staggered. Therefore, we propose testing this by using our primary model on staggered elections. The result is presented in the first column of the Table 5. In this case, we see that staggered competitive elections do not give rise to the manipulation of forest rent. However, generally displaced elections

Table 5: Exploring the heterogeneity

	1	2	3	4	5	6	7
	Delayed	Incub_run	Dont_run	Hight_curru	Low_curru	Hight_Freed	Low_Freed
L.Forest_rent	0.7285*** (0.0208)	0.7293*** (0.0209)	0.7272*** (0.0210)	0.7998*** (0.0252)	0.6778*** (0.0254)	0.8235*** (0.0243)	0.7140*** (0.0239)
Delayed	0.6080* (0.3227)						
Delayed_comp	-0.8011 (1.0370)						
Polcon	-0.9374*** (0.2551)	-1.0434*** (0.2597)	-0.9995*** (0.2570)	-0.3835* (0.2279)	-1.6981*** (0.4465)	-0.3984* (0.2063)	-1.5872*** (0.4616)
Corruption	-0.1537*** (0.0559)	-0.1504*** (0.0557)	-0.1565*** (0.0558)	-0.0236 (0.0452)	-0.3225*** (0.1107)	-0.0816** (0.0389)	-0.2329*** (0.0898)
GDPperCap	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0001)	0.0000 (0.0000)	0.0000 (0.0001)
Depl	0.0570*** (0.0109)	0.0571*** (0.0109)	0.0571*** (0.0109)	0.0632*** (0.0150)	0.0602*** (0.0145)	0.0028 (0.0142)	0.0702*** (0.0128)
UrbanPop	0.0141 (0.0178)	0.0138 (0.0177)	0.0151 (0.0177)	-0.0077 (0.0140)	0.0476 (0.0307)	0.0108 (0.0103)	0.0131 (0.0287)
Democ	0.0002 (0.0045)	-0.0010 (0.0044)	-0.0007 (0.0045)	-0.0128* (0.0067)	0.0055 (0.0082)	-0.0054* (0.0031)	0.0133 (0.0097)
Incub_Run		-0.6604*** (0.1884)					
Incub x comp		1.1124** (0.5664)					
Dont_run			-0.1863 (0.2181)				
Dont x comp			0.6009 (0.5650)				
Elect				0.1494 (0.1822)	-1.0424*** (0.2943)	-0.2938* (0.1578)	-0.6089* (0.3245)
Elect_Con				-0.2965 (0.4645)	1.7423* (0.9128)	0.7660** (0.3729)	0.8926 (1.0300)
<i>N</i>	2010	2010	2010	1049	961	907	1103
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Countries	83	83	83	41	42	37	46

Notes: N=2010, t statistics in parentheses

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

result in higher forest rents. We see this in our results through the positive and significant coefficient of the variable *Delayed* in the first column. This result is explained by the delayed elections, which give the incumbent time to manipulate the voters' choices.

7.2 In case of representation of the candidate in power

We want to test the heterogeneity of our results by verifying whether cycles did indeed occur when candidates for power were represented. When the candidate stands for re-election or if his political party stands for re-election, he has every reason to carry out manipulations to signal his competence to be re-elected. Thus, one should see cycles in the case of the representation of the candidate in power. To test this, we break our elections down into two. Elections in which the president in power is running and elections in which the president in power is not running. The results are presented in the Columns [2-3] of Table 5. Consistent with our main results, election cycles appear when the ruling candidate runs for office again. We find results consistent with the literature.

7.3 Depending on the level of corruption

We also tested the sensitivity of our results by considering countries' levels of corruption. While it is true that we take into account the level of competitiveness of the elections, the level of corruption within the country can affect political cycles. Corruption can reduce the need to increase rents since results can be manipulated, for example. To test this, we have divided our countries into two groups according to the median. Our results in the Columns [4-5] of Table 5 are unsurprising. Political cycles at the level of forest rents are observed only at the level of countries with a low level of corruption, i.e., at the level of the group with the lowest level of corruption.

7.4 Depending on the level of freedom

According to the literature, the population’s education level, the age of democracy, or even access to information are factors conditioning the probability of the appearance of political cycles. Indeed, these different factors affect the ability of the voting population to understand the manipulations of politicians and their intentions. We proposed to test the sensitivity of our results according to the level of freedom in the different countries. Our results in the two last columns (Columns [6-7]) of Table 5 show that countries with a high level of human freedoms experience rents’ negative political cycles.

8 Conclusion

This paper aims to detect possible electoral cycles in natural resource rents in developing countries. Still-developing institutions and nascent democracies usually characterize these countries. We worked on a sample of eighty-three (83) countries and used the Nickel bias-corrected generalized least squares estimator proposed by Bruno (2005) and used by Gootjes *et al.* (2021); Debrun *et al.* (2008); Bogliacino *et al.* (2012). This estimator has the advantage of being operational even on small samples. Overall, our results suggest that forest rents in developing countries are not subject to cycles in the case of elections in general. However, the competitiveness of elections seems to be a factor that conditions electoral cycles in natural resource rents. Indeed, considering the elections’ competitiveness, positive cycles appear. The most competitive elections are characterized by positive political cycles, while non-competitive elections give rise to negative political cycles due to a diversion of the rents.

We tested the robustness of these results using the Anderson-Hsiao and Arellano-Bover estimators. We also re-estimated our primary model using less restrictive Nickel bias corrections. In a third robustness test, we used the GMM estimator to tackle the endogeneity issue from the dynamic specification and the double causality between rents and electoral competition. We also added control variables to confirm the stability

of the interest coefficients. We focused on more forest rents dependent countries and used placebo tests; the results remained the same. Finally, we reduced our sample to countries dependent on forest resources. Our results come out robust after all these tests. The heterogeneity analysis showed us that it is mainly the elections during which the president is running for re-election. These cycles appear only in low-corrupt countries and countries with high human freedom.

Our work suffers from some limitations that could be sources of extension of the present study. The first is using total natural resource rents in place of the rents effectively received by governments. This is beyond our control and is due to the lack of data. The Extractive Industries Transparency Initiative (EITI)⁸ database⁹, which contains this information, exists but is too recent. In the coming years, as the time horizon of the database lengthens, higher-quality work could be done. Another limitation of our work is that the different channels could have been tested more thoroughly, depending on data availability and completeness. These include, for example, the number of operating permits granted or the tax rate in the mining sector over our study period. Indeed, it would be interesting to study how operating permits evolve with elections. As we have seen, elements of the literature show us that in certain precise countries, these exploitation permits were subject to cycles.

These different results lead us to draw some conclusions. The few competitive elections that take place generate cycles because of the manipulation of candidates for power due to the youth of democracies. On this basis, economic policy recommendations can be made. Indeed, manipulation for re-election purposes has adverse effects on the economy. Therefore, having solid institutions, including independent structures for natural resource management, is crucial. Also, since a high level of democracy is associated with an absence of cycles, developing countries should be encouraged to continue their march toward democracy, which cannot be done without the help of the international community. However, the same individuals who hold power will

⁸<https://eiti.org/fr>

⁹<https://eiti.org/fr/donnees-ouvertes>

implement these various measures. The most effective way is to build a vibrant civil society. This refers to the human capital of countries. Therefore, a medium- and long-term fight against these political manipulations of rents should also involve investing in the population's education so that they can understand the political game during the election period.

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9 Annexe

Table 6: List of countries included in the analysis

Albania	Algeria	Angola	Argentina	Armenia	Azerbaijan	Bangladesh	Belarus
Bolivia	Botswana	Brazil	Bulgaria	Burkina Faso	Cameroon	Chile	China
Colombia	Congo, Dem. Rep.	Costa Rica	Cote d'Ivoire	Ecuador	El Salvador	Ethiopia	Finland
Gabon	Gambia	Ghana	Guatemala	Guinea	Guinea-Bissau	Guyana	Haiti
Honduras	Hungary	India	Indonesia	Jamaica	Jordan	Kazakhstan	Kenya
Kuwait	Lebanon	Liberia	Libya	Madagascar	Malawi	Malaysia	Mali
Mexico	Moldova	Mongolia	Morocco	Mozambique	Namibia	Nicaragua	Niger
Nigeria	Pakistan	Panama	Papua New Guinea	Paraguay	Peru	Philippines	Poland
Qatar	Saudi Arabia	Senegal	Serbia	Sierra Leone	South Africa	Sri Lanka	Sudan
Tanzania	Thailand	Togo	Tunisia	Turkey	Uganda	Ukraine	Uruguay
Vietnam	Zambia	Zimbabwe					

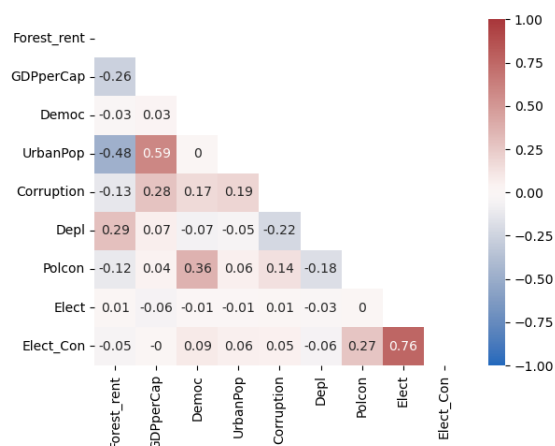


Figure 4: Correlation

Table 8: List and sources of variables

Variable	Definitions	Sources
Forest rents	Annual forest rents of countries as a percentage of GDP	World Bank (2019) Et The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium (World Bank, 2011)

Political constraints	Political constraint index: the number of veto actors in the political system	POLCON by Witold Jerzy Henisz
Elect	Variable from the pre-election period	National Elections Across Democracy and Autocracy Dataset, 5.0 (NELDA)
Elect_Con	Elections taking into account their level of competitiveness	Calculation of authors using Elect and Polcon variables
Corruption	Level of corruption within a country	International Country Risk Guide ¹⁰
GDP per capita	GDP per capita in constant dollars	World Bank (2019)
Urbanization rate	Share of the urban population in the total population	World Bank (2019)
Level of democracy	Degree of democracy in the country	POLITY5 Political Regime Characteristics and Transitions, 1800-2018

¹⁰<https://www.prsgroup.com/explore-our-products/icrg/>

Exchange rate	Official annual exchange rate (Average for the period)	World Bank (2019)
Dependency ratio	Dependency ratio in the country as a percentage of the working-age population	World Bank (2019)

Table 7: Correlation Table

	Forest_rent	GDPperCap	Democ	UrbanPop	Corruption	Depl	Polcon	Elect	Elect x Co
Forest_rent	1.0***	-0.26***	-0.03	-0.48***	-0.13***	0.29***	-0.12***	0.01	-0.05*
GDPperCap	-0.26***	1.0***	0.03	0.59***	0.28***	0.07**	0.04*	-0.06**	-0.0
Democ	-0.03	0.03	1.0***	0.0	0.17***	-0.07**	0.36***	-0.01	0.09***
UrbanPop	-0.48***	0.59***	0.0	1.0***	0.19***	-0.05*	0.06**	-0.01	0.06**
Corruption	-0.13***	0.28***	0.17***	0.19***	1.0***	-0.22***	0.14***	0.01	0.05*
Depl	0.29***	0.07**	-0.07**	-0.05*	-0.22***	1.0***	-0.18***	-0.03	-0.06**
Polcon	-0.12***	0.04*	0.36***	0.06**	0.14***	-0.18***	1.0***	0.0	0.27***
Elect	0.01	-0.06**	-0.01	-0.01	0.01	-0.03	0.0	1.0***	0.76***
Elect x Con	-0.05*	-0.0	0.09***	0.06**	0.05*	-0.06**	0.27***	0.76***	1.0***

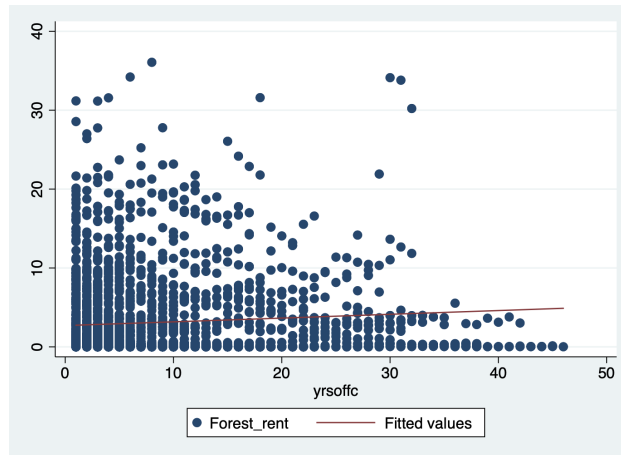


Figure 5: Relationship between Forest rents and tenure