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Policy market orientation, property rights, and corruption effects on the rent of non-renewable resources in Latin America and the Caribbean

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ABSTRACT

This study aims to evaluate the role of two institutional variables (property rights and corruption) and two outward-oriented policies (trade and capital account openness) on the rents of non-renewable natural resources in Latin America and the Caribbean. The sample under study involves data from 20 countries during the period 1971–2019.

Thus, we attempt to explore the long-run relationship between the aforementioned variables. The methodological procedure involved checking for cross-sectional dependence and evaluating the order of integration of the variables. We have also verified the coefficients' slope homogeneity and the absence of structural breaks, as well as confirming cointegration. Finally, we have estimated the model using two techniques; Park's Feasible Generalized Least Squares and a new instrumental variable approach put forward by Norkute et al. (2021) and Cui et al. (2022).

Better property rights laws, according to our research, benefit rents. In contrast, we have demonstrated that corruption has a detrimental effect, supporting the "sand in the wheel hypothesis." On the other side, the findings show that opening trade and capital accounts has a favorable effect on rents. Our findings thus serve as a warning about the need to enhance the quality of institutions by lowering political risk, encouraging upstanding legal principles, and combating corruption. Last but not least, in agreement with Arezki et al. (2019), our results clearly support the notion that an outward market orientation has a favorable impact on the endowments of non-renewable natural resources.

1. Introduction

There is no doubt that natural resources, renewable and non-renewable, are important growth drivers for the Latin America and Caribbean (LAC) economies (Kristjanpoller et al., 2016; Zeeshan et al., 2020; Le Clech, 2023; Le Clech and Guevara-Pérez, 2023). For example, Le and Bao (2019) have shown that both renewable and non-renewable energy use has a positive impact on the LAC economic growth. Moreover, Le Clech (2023), and Le Clech and Guevara-Pérez (2023) found that natural resources and energy endowments play a critical role in the productivity gains of this region.

In addition, this sector, especially the extractive industry, is a critical source of fiscal revenues for many countries in the region (Lopez-Murphy and Villafuerte, 2010; Alvarado et al., 2022). Moreover, most LAC countries are important commodity exporters (Kristjanpoller et al., 2016). These revenues from exports raise the purchasing power of their currency, which improves wages and government spending possibilities (Alvarado et al., 2022).

There are other areas in which natural resources play a critical role. For example, some studies have demonstrated that non-renewable natural resources endowments have also a positive long-run effect on the accumulation of physical and human capital in the LAC economies (Blanco and Grier, 2012; Le Clech et al., 2023).

Even more, they are also relevant to the environment, although there is some controversy on this issue. For instance, a recent work by Wang et al. (2023a) has shown that it is more likely that openness to trade benefits environmental quality when natural resource rents are high. Similar results were found by Wang et al. (2023b) when studying the effect of the digital economy on CO2 emissions. In contrast, another study by Wang et al. (2023c) has found that the effect on carbon emissions is verified in only a few countries, i.e., natural resource rents and trade openness have a minor mitigation effect on pollution. Similarly, Wang et al. (2022) posited that trade openness and natural resource rents increase environmental pressure. Other studies, such as Alvarado et al. (2021) found mixed results, depending on the level of development of the economies analyzed.

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Even though this sector has great relevance for this region, most studies have approached these topics through the lens of the "natural resource curse hypothesis" (NRCH).[1] Within NRCH there are different channels through which the 'curse' acts (see Frankel, 2012; Badeeb et al., 2017). The original NRCH considers natural resource endowments as exogenous variables. But new studies have turned their approach in the opposite direction (Ross, 2015; Arezki et al., 2019; Dogan et al., 2021; Liu et al., 2022). This is the approach that this study will follow, i.e., while NRCH posits a causal relationship direction from natural resource endowment to other variables, this paper will consider the inverse channel of causation, in the sense that it was proposed by Arezki et al. (2019, p. 1):

"Actual endowments of oil, gas and minerals depend on geological factors that are exogenous. The knowledge and availability of these endowments for exploitation, on the other hand, is endogenous. Indeed, the perceived availability depends on exploration efforts, which in turn depend on factors such as market orientation, economic liberalization and institutions."

The aforementioned paragraph lays the foundation from which we will conduct our analysis of how institutional change can affect natural resource outcomes. Thereby, this paper aims to evaluate the effect of property rights and corruption on non-renewable natural resource rents in Latin America and the Caribbean. Furthermore, we take the proposed agenda for future research suggested by Dogan et al. (2021) and investigate the relationship between globalization and resource rents. More specifically, we will study the effects of trade and financial openness.

In this regard, it is important to note that non-renewable resources are capital-intensive industries, so they need to attract a sizeable amount of investment to be developed. This flow of financial resources, in many cases, comes from different points of the world in the form of foreign direct investment (FDI), mainly from developed to developing countries. These investors consider several aspects of the economy since this sector is inherently risky for investors, due to the amount of sunk investment frequently required in these projects, the geological uncertainty, and the price volatility of commodities. This uncertainty can be exacerbated and investors deterred by institutional and political instability in the host country (Venables, 2016). In sum, institutional quality and outward-oriented policies have a direct impact on the attraction of FDI to the natural resources sector (Poelhekke and van der Ploeg, 2013).

On the other hand, the common view that this industry is simply an extractive activity, in which the products are only extracted, not produced (Badeeb et al., 2017), should be revised. The extraction and the process to get the final product not only need large-scale investments in exploration, but also expertise in geological knowledge, advanced technologies of extraction and refining, and good infrastructure for transportation (Wright and Czelusta, 2004; Venables, 2016). Both technological progress in extraction and exploration are relevant since they drop the marginal cost of extraction.

In other words, the non-renewable sector, especially the process of generating rents, is likely affected by the institutional framework and economic policies rather than being the key determinant of these institutional frameworks. As Ross (2015, p. 243) has pointed out "Yet empirical studies consistently show that the opposite is true: bad political conditions lead to less oil exploration and production, not more." From this approach, the study acquires greater relevance for this region given the political changes observed in the LAC economies in recent decades, in which several countries have turned towards interventionist and illiberal models.

These political changes have been evident during the first two decades of this century. While at the end of the 1980s and the beginning of the 1990s there was almost unanimous agreement in the region regarding the benefits of implementing market-oriented reforms, the situation has changed significantly from the middle of the 1990s to the end of the century. At that time, several economic crises affected the region, and these stirred some controversy (and criticism) about the benefits of those pro-market reforms (Goldfajn et al., 2021).

In the region, there has been an intense debate on the role of individual and business freedoms in economic development (Alvarado et al., 2022), and, by the end of the 1990s, several LAC countries had moved towards development models in which statist and socialist policies prevailed. Thereby, during the XXI century, an increasing number of countries adopted autocratic leadership. In some cases, the executives showed overtly authoritarian tendencies (Velasco Guachalla et al., 2021). This trend has been accentuated in the last few years in many countries in this region.

Nonetheless, these movements to the left were not uniform (Weyland, 2009). Whilst some countries maintained some respect for individual freedom and preserved some degree of economic discipline, others have evolved into unstable economic and authoritarian systems. In this context, the robustness of democracy has played an important role. The evidence has shown that some moderately liberal policies have prevailed in those countries with well-developed party systems and healthy democracies. While in those countries, where these pillars were in crisis, governments implemented heterodox policies or went directly to deepest statism (Levitsky and Roberts, 2011). This orientation towards heterodox policies and greater statism has been reinforced by the results of the last elections in the region.

For these reasons, we think that our study can shed some light on the implications of the policies adopted by the new governments and that such findings are useful as input for future decision-making. In addition to this motivation, focusing the study on a specific region has other advantages. For instance, when working with a single region, the likelihood that the observations come from the same data-generating process increases (Blanco and Grier, 2012). Moreover, as the region shares a similar historical background and related contemporaneous political trends, the risk of heterogeneity in the economic policy and institutional parameters diminishes.

In general, the effect of institutions and globalization on natural resource rents is a topic that is still understudied, and it is a topic that is present in the actual research agenda (Ross, 2015; Arezki et al., 2019; Dogan et al., 2021; Liu et al., 2022). Therefore, our study is an attempt to fill this gap. Moreover, to the best of our knowledge, this study is pioneering in this research area from this approach, especially regarding the evidence offered for the LAC region.[2]

In sum, the main contributions of this work can be summarised in the following three points: 1) We consider a distinct approach of that of NRCH by analyzing the causal effect of corruption and property rights on natural resource rents. This will make it possible to capture the impact of these two institutional variables on the rent of this sector, which is very useful for the design of sector policies, 2) We also study the effect of trade and capital account liberalization on natural resource rents, a topic that is still understudied, especially in the LAC economies, and 3) The study of these issues acquires greater relevance given the changes in the orientation of the economic policy promoted by several countries in the region in recent times. Thus, it will allow us to identify the relevance of institutional quality and market-oriented policies on the performance of the non-renewable resource sector, serving as an alert about the potential effect of the economic policies promoted by various governments in the region.

The paper proceeds as follows. The next section outlines the relevant literature review. Section 3 presents the model and describes the data, while Section 4 presents the econometric methodology and the results.

[1] The literature on resource curse hypothesis is extensive. Some relevant reviews can be found at; Deacon (2011), van der Ploeg (2011), Frankel (2012), and Badeeb et al. (2017) and others.

[2] The data available has allowed us to build a database for the period 1971–2019 involving 20 LAC countries.

Finally, Section 5 presents a discussion of the results, and Section 6 offers concluding remarks and policy recommendations.

2. Literature review

From the lens of NRCH, Robinson et al. (2006, 2014) developed a theoretical model that explains the effect that resource endowments generate on political incentives. However, these effects depend critically on the political structure, i.e., on the institutional quality and the sort of policies that this framework produces. The model predicts that in countries where the government promotes accountability and competence, the NRCH is not valid, otherwise, the hypothesis is confirmed.

In the empirical field, during recent decades, the NRCH literature has paid more attention to the association between natural resource wealth and political institutions (Brunnschweiler, 2008; Bergougui and Murshed, 2020). Some authors, such as Kolstad and Wiig (2008), argued that the key factor that explains the curse is resource rent rather than resource abundance because the former has a greater impact on institutions, such as corruption. On the other hand, Perez and Claveria (2020) have suggested that corruption might be the cause that hinders natural resource rents from contributing to economic growth. Other studies have even recognized that resource-rich countries with 'good' institutions can transform the curse into a blessing (Boschini et al., 2007; van der Ploeg, 2011). As a result, it can be said that the key variable that determines the 'curse' effect of natural resource endowment is the institutional framework, not the resources themselves. In addition, Majumder et al. (2020) have claimed that the 'curse' effect can be reduced by opening the economies to international trade.

In this line, new works emphasize the link between natural resources and poor policies and institutions, especially regarding corruption (Bhattacharyya and Hodler, 2010) and insecurity in property rights (de Soysa et al., 2022). These studies claim that the 'curse' effect occurs because of the institutional impact. So, natural resource abundance worsens institutions, and this impacts negatively on growth. This last approach, which still focuses on the causality from natural resources to institutions, suggests certain differences in this relationship concerning the moment in which new non-renewable resource discoveries are generated.

Thus, if a country already enjoyed 'good' institutions before the discoveries, the results are likely to be the opposite of those indicated by the NRCH. In other words, the NRCH is verified when 'poor' institutions are present, otherwise, resource abundance can be a blessing. In the words of Mehlum et al. (2006, p. 1); "More natural resources push aggregate income down, when institutions are grabber friendly, while more resources raise income when institutions are producer friendly …"

Furthermore, a recent study by Bergougui and Murshed (2020), who studied the relationship between oil abundance (and dependence) and five democratic indicators, did not find any significant effects from oil abundance (or dependence) on each of the five measures of democracy. However, they do find evidence of the role of institutional quality, measured by the rule of law, in designing policies to enhance resource management. Therefore, they posit that the effect of oil abundance (and dependence) is on the quality of institutions and then on democracy. In other words, the effect of oil abundance (and dependence) on democracy is conditional on the quality of institutions.

Some specific studies conducted on the LAC region, such as Haber and Menaldo (2012), also found no evidence that natural resource dependence undermines democracy or institutional quality. On the contrary, their results suggest that the blessing hypothesis prevails. Similar results have been found by other studies, which did not find strong evidence of the dependence effect in the region regarding other indicators such as human and physical capital accumulation, economic growth, or productivity (Blanco and Grier, 2012; Toscani, 2017; Papyrakis and Pellegrini, 2019; Le Clech, 2023; Le Clech and Guevara-Pérez, 2023; Le Clech et al., 2023). A recent study by Azam (2022) has shown that corruption discourages growth in the LAC region, while government effectiveness and political stability have a positive impact on economic growth and the productivity of the region (Le Clech, 2023; Le Clech and Guevara-Pérez, 2023).

Other authors identify this causal relationship between institutions and policies toward natural resources more directly. For example, Brunnschweiler and Bulte (2008), Norman (2009), Frankel (2012), Ross (2015), Alsharif and Bhattacharyya (2019), and Arezki et al. (2019) have claimed that causality may run in the other direction. They also recommended that it should differentiate between resource abundance and resource rents since they are stock and flow variables.

In this line of argument, a recent study by Arezki et al. (2019), which analyzed the effect of market orientation on natural resource wealth, claimed that this assumption of exogeneity must be called into question. Norman (2009) had already pointed out that both discovery and development are not purely exogenous, but probably endogenous. A similar approach was followed by Liu et al. (2022), who analyzed the impact of governance quality, globalization, and financial development on the volatility of natural resource rents. This new point of view changes the direction of causality, now it is the institutions and the policies that cause the stocks (Arezki et al., 2019; Cust and Harding, 2020) and flows (Canh et al., 2020; Liu et al., 2022) of non-renewable natural resources.

2.1. Property rights

The state is the owner of subsoil assets in almost all countries in the world (Venables, 2016). In particular, in LAC countries, states have sovereign rights over these sorts of natural resources. This monopoly position on reserves and rents has been exploited in two ways; one is by allowing the private sector (in some cases mixed companies) to exploit the resources under different types of government controls. The other is by maintaining direct control of production through a state-owned company. In any case, the state is the direct owner or lessee of the assets, collecting significant tax revenue through three different mechanisms; an initial payment to obtain the exploitation right, royalty payments, and specific taxes on production and sales (Balza and Espinasa, 2015).

This means that any apparent risk of expropriation or even threats to the 'status quo' have a profound effect on investment decisions. The aftermath of this sort of political environment can trigger a downward spiral in investment, production, and rents. Especially for FDI which usually flows to countries in which individual and business freedom are guaranteed (Alvarado et al., 2022). In other words, when property rights are poorly defined, ownership is insecure. In this context, the investors are not willing to invest to exploit the natural resource stocks, and they may remain unused until the conditions change (Bohn and Deacon, 2000; Cust and Harding, 2020).

One of the pioneering works in analyzing the effect of property rights on natural resources is that of Bohn and Deacon (2000). These authors developed a theoretical model which predicts two opposite effects. In the first place, ownership risk will increase production since firms will extract and sell as much as possible before the eventual expropriation. On the other hand, a risk to property rights would also reduce investments, raising costs and reducing extraction. Despite these conflicting results, they pointed out that the latter effect will dominate in capital-intensive industries. This last feature is supported by their empirical findings, which were also recently confirmed by Cust and Harding (2020).

A recent study by de Soysa et al. (2022), which studied the effect of oil production on property rights (inverse causality), has proposed two hypotheses that link natural resources with both property rights and corruption. Regarding property rights, they posited that economic interest groups prefer to keep property rights insecure for their benefit. These hypotheses have special relevance to our study since we would expect a negative effect on the rents perceived by those interest groups when property rights improve. On the other hand, if better property

rights have a positive effect on rents, the hypothesis would not be valid for LAC countries.

2.2. Corruption

This is one of those topics in which there are some controversial points of view. Some authors have suggested that corruption might stimulate economic growth. The two first authors to defend these ideas were Leff (1964) and Huntington (1968). They presented the so-called "grease the wheel hypothesis", which states that corruption drives business forward. In other words, corruption is not always growth-inhibitory, and, for some countries, corruption is growth-enhancing (Girijasankar and Shrabani, 2016). On the other hand, authors such as Shleifer and Vishny (1993) have developed the opposite hypothesis, i.e., that corruption impairs economics, this is the so-called "sands in the wheel hypothesis".

2.2.1. Grease the wheel hypothesis

This hypothesis posits that corruption could guarantee efficient outcomes in the competition for government procurement contracts. The reason for this is that more productive entrepreneurs can pay higher bribes to the government. Therefore, contracts would be assigned to the most efficient firms (Lui, 1985; Beck and Maher, 1986). So bureaucrats have the incentive to drive the most inefficient firms out, enhancing the more profitable ones that remain, which in turn allows them to demand higher bribes. For example, Bliss and Di Tella (1997) developed a model that demonstrates that this behavior has rational arguments, concluding that it could not necessarily mean a reduction in social welfare.

The argument is that corruption may promote allocative efficiency by allowing firms to correct pre-existing government failures, such as weak institutions or stiff regulations (Gamberoni et al., 2016). In the case of the LAC region, Urbina and Rodríguez (2021) found evidence for this hypothesis. Their findings depict that corruption encourages the natural resources sector.

2.2.2. Sands in the wheel hypothesis

This states that the negative effect between corruption and investment is due to the existence of a weak central government that allows an increasing structure of corruption, reaching such levels that completely discourage investment (Shleifer and Vishny, 1993). Moreover, this attitude could encourage the consolidation of some monopoly sectors if they assure such corruption practices. This happened because demands for secrecy can also cause bureaucrats to prop up inefficient firms, preventing the entry of other "unfriendly" firms. This would discourage innovation resulting in the relocation of talent, technology, and capital away from their most productive uses (Murphy et al., 1991, 1993; Gamberoni et al., 2016).

In addition, some authors have argued that corruption lowers the marginal gains of capital (Dissou and Yakaustava, 2012), discouraging both national and FDI. Thus, corruption can lead to lower levels of investment in infrastructure, both public and private, and it also deteriorates the investment climate of a nation (Tanzi and Davoodi, 1998). Regarding FDI some recent studies have confirmed the negative relationship (Ketkar et al., 2005; Busse and Hefeker, 2007; Al-Sadig, 2009; Mathur and Singh, 2013).

2.2.3. Natural resources and corruption (and vice-versa)

The two hypotheses mentioned above offer riveting arguments for analyzing the relationships between natural resource rents and corruption since they focus on the influence of corruption on the business environment. Those two approaches analyze the impact of corruption on other variables, such as investment, innovation, profits, FDI, and economic growth (among other relationships). However, the direction of causality is from corruption towards economic variables. Hence, from these approaches, corruption would affect the rent through those channels. In this case, natural resource rent is not a determinant of corruption.

Nevertheless, when we study this topic in the natural resources area, we can see that it has been mainly approached from the inverse direction, i.e., from natural resource endowment to corruption. Some authors argued that the abundance of natural resources encourages rent-seeking behavior and patronage, and hence, government officials might be encouraged into corrupt activities (Leite and Weidmann, 1999; Kolstad and Søreide, 2009). This would cause lower innovation and entrepreneurial activity, producing low-quality governments and then poor economic growth (Sachs and Warner, 2001; Mehlum et al., 2006). Here, the results are similar to those posited by the 'sands in the wheel hypothesis' (SWH), but the origin is different (Natural resource – corruption – SWH).

Other scholars have argued that the main cause of the NRCH is corruption itself and not the abundance of resources. This last argument has been studied by Shadabi and Adkisson (2021), who did not find strong evidence that the rents on natural resources foster corruption. In general, they suggested that it depends on the type of government. With autocratic governance, it seems that the relationship between natural resources and corruption is not so weak. The opposite occurs when there is some level of institutional quality. For example, Bhattacharyya and Hodler (2010) pointed out that resource rents favor corruption only in countries with poor democratic institutions. When governments are stable and promote economic freedom, corruption tends to have a minor impact, even in the presence of resource abundance (Bergougui and Murshed, 2020; Shadabi and Adkisson, 2021). In sum, it seems that the relationship between natural resources and corruption is strong only in non-democratic regimes (Arezki and Gylfason, 2013).

Despite everything, it is not clear whether the origin of corruption is the endowment of natural resources or other causes. Either the effect on economic dynamics in general or on the non-renewable sector, in particular, is not clear. Whether corruption raises production costs, or decreases productive efficiency (sand the wheel hypothesis), or facilitates business, for example, by allowing a greater environmental impact that reduces costs (grease the wheel hypothesis), is still an open debate.[3]

Finally, the second hypothesis proposed by de Soysa et al. (2022), which is of interest, states that concentrated interest groups stimulate patronage and political corruption. Therefore, if the effect of corruption on rents is positive, it would be evidence in favor of de Soysa et al.'s hypothesis. On the other hand, if the effect is negative, this influence is not present, and the hypothesis would not be valid for LAC countries.

2.3. Economic opening policies

Even for the NRCH, market-oriented policies are important. For instance, Arezki and van der Ploeg (2007) have found that opening trade policies reduces the effect of the resource curse. Even more, they have pointed out that this policy orientation may turn it into a blessing. This effect of market-oriented policies is not only relevant in discoveries but also in production.

Arezki et al. (2019) have pointed out that the economic opening, experienced in LAC countries since the early 1990s, has played an important role in new non-renewable resource discoveries in the region. Those countries that follow openness policies increase significantly their discoveries of natural resources. These authors found that policies oriented toward economic liberalization generate more natural resource discoveries, which boost extractive activities and wealth. This policy orientation improves the transfer of technology and raises the flow of capital, making exploration more attractive for the stakeholders.

[3] Regarding the impact on the environment, a recent study by Wang et al. (2023a) has shown that corruption harms the environment since high levels of corruption reduce the strictness of environmental supervision. Therefore, reducing corruption would reinforce the positive effect of economic openness on the environment quality.

International markets can play a significant role in demanding non-renewable commodities. Thus, a policy of integration into the international market combined with appropriate incentives for investing to compete internationally can benefit the economy (Zaidi et al., 2019; Majumder et al., 2020). This is especially important for LAC countries since they are highly dependent on natural resource exports for their economic growth (Kristjanpoller et al., 2016). They are also largely dependent on imports since they need special equipment and machinery used in this industry, which are produced abroad. Furthermore, opening policies are associated with efficient technology transfer (Xiaoman et al., 2021), thereby, this link to the global economy is also relevant to acquiring the technical capacity required in this industry. For those reasons, being part of economic globalization can be crucial for this region. Trading internationally will help the economies obtain competitive prices for their natural resources exports and will give them access to advanced technologies to extract resources more efficiently (Majumder et al., 2020).

Moreover, as this industry is intensive in knowledge and new technology (Wright and Czelusta, 2004), it can generate strong dependency from abroad, and this could reduce the policymakers' discretion in guiding them to international standards. For example, the 'Vaca Muerta' shale gas and oil resources in Argentina were discovered in 1931, but it was not until the late 2010s that technology allowed their exploitation to become economically viable, and the main technology for it was developed abroad. International linkages and dependence on new technology are probably the factors that reduce the likelihood of expropriation, which in turn is a key factor for attracting new FDI. This fact explains the FDI affluence in 'Vaca Muerta' despite the political and economic instability of Argentina (Collins et al., 2021). Another example of how institutions can affect the development of this industry was explained by Monaldi et al. (2021), who analyzed the case of Venezuela.

For its part, financial openness is also important since it can provide funding to support this capital-intensive industry. Foreign direct investment can play a key role, as well as other financial flows. It also promotes new technical skills, improves efficiency, and is an important driver of technology transfer (Poelhekke and van der Ploeg, 2013). Moreover, FDI is a key determinant of natural resource production and energy consumption, as well as an important promotor of financial development and economic growth in the LAC region (Zeeshan et al., 2020).

In the case of oil production in the LAC region, Balza and Espinasa (2015) have studied the reasons that explain the dissimilar performance of oil production after the price boom recorded in 2002. They explain that this distinct behavior is related to different characteristics of the institutional framework. Furthermore, they have shown that in those countries in which the institutional framework promoted investment and private activity, fostered competition from state companies, and promoted government transparency, oil production reacted positively in response to rising prices.

3. Model and data

This paper aims to analyze the effects of two institutional variables (property rights and corruption) and the foreign policy orientation (trade and financial openness) on the non-renewable natural resource rent. In addition to these four variables, several studies have identified the income level of the economy as a key control variable for natural resource regressions (Arezki et al., 2019; Canh et al., 2020; Ben-Salha et al., 2021; Dogan et al., 2021; Liu et al., 2022).

Economic growth may boost natural resource rents by raising demand, and also by creating opportunities for new investments, which can also stimulate some technological improvements (Dogan et al., 2021). Moreover, the dependence on non-renewable energy use in sectors like agriculture and traditional manufacturing is strong in LAC countries (Zeeshan et al., 2020). This dependence leads to non-renewable resources having a strong demand for the growth process (Nasreen and Anwar, 2014; Alvarado et al., 2022).

Therefore, we will include the gross domestic product per capita (GDPPC) in our model in logarithms (lngdppc). The general equation can be written as follows:

$$ln\ rent_{it} = f\left(lngdppc_{it};\ Prights_{it}; Corrupt_{it}; Trade_{it}; Finance_{it}\right) \quad (1)$$

where lnrent is the logarithm of the total rent produced by four non-renewable resource sectors, namely; Coal, Natural Gas, Oil, and Minerals. This variable is based on the information provided by the World Bank through the variables Coal rents (% of GDP), Oil rents (% of GDP), Natural gas rents (% of GDP), and Mineral rents (% of GDP). Summing up these shares, we have the total non-renewable resource rent share as % of GDP. Then we multiplied this total share by the total annual gross domestic product (GDP) divided by 100. Similar to Cust and Harding (2020), we used the variable 'RGDP^{o}' from 'Penn World Table 10'. (RGDP^{o}: Output-side real GDP at chained PPPs measured in mil. 2017US $).[4]

The variable 'lngdppc' is simply measured by dividing the GDP by the population from 'Penn World Table 10' and taking logarithms. We have chosen the Output-side real GDP at chained PPPs variable because it intends to measure the productive capacity of the economies and is less affected by variations in the terms of trade. Besides, this measure is calculated with prices that are constant across countries and over time (Feenstra et al., 2015). Moreover, we think that PPP is a better measure than the market (official) exchange rate (ER) because the ER does not always account for the difference in prices between economies, especially in economies with pegged ER systems or ER controls that generate black market ER. All these situations were common in several countries during the period of analysis.

In our model, we have considered two institutional variables that we gather from the 'Varieties of Democracy (V-Dem) Project' (Coppedge et al., 2022a; Pemstein et al., 2022). The first one, Property Rights (Prights), is measured by the "Property rights (D) (v2xcl_prpty)" variable which includes "the right to acquire, possess, inherit, and sell private property, including land. Limits on property rights may come from the state which may legally limit rights or fail to enforce them; customary laws and practices; or religious or social norms. This question concerns the right to private property, not actual ownership of property" (Coppedge et al., 2022b, pp. 304). This index is scaled 0–1, where the more security in the property rights the highest the value of the index.[5]

The second institutional variable, Corruption (Corrupt), is the simple average of three indexes from the 'Varieties of Democracy (V-Dem) Project' database; "Political corruption index (D) (v2x_corr)," "Executive corruption index (D) (v2x_execorr)" and "Public sector corruption index (D) (v2x_pubcorr)," (For further details see Coppedge et al., 2022b, pp. 300–301). These indexes are also scaled 0–1, with a notable difference concerning other similar indices, which is that these indexes measure corruption on an ascending scale, in that sense, the more corruption in a country, the higher the score achieved in the index. Both institutional variables, Prights and Corrupt, were multiplied by 100 to rescale them 0–100.

We have also considered two variables of policy orientation which attempt to capture the effect of the outward policy on rent from a broad perspective. In this way, we have considered two categories that affect deeply this industry, namely, Trade (Trade) and Financial (Financial) Openness. For measuring these two variables, we use two indexes from

[4] Due to the fact that the variable Rent presents some values equal to zero, the direct application of the logarithm is not possible, therefore, as Bergougui and Murshed (2020), it was calculated as log(1+Rent).

[5] For instance, in the field of non-renewable resource studies, the V-Dem database has been used by Bergougui and Murshed (2020), de Soysa et al. (2022) and Ruzzante and Sobrinho (2022).

the KOF Globalisation Index (Gygli et al., 2019); They are the "Trade Globalization Index" (TGI) and "Financial Globalization Index" (FGI) measured by the variables KOFTrGI and KOFFiGI in the KOF database, respectively.[6]

These indexes are constructed by averaging two subcomponents of each index; 'de facto' and 'de jure'. For instance, the TGI de facto includes categories such as trade in goods and services and a measure of trade diversity. In addition, the TGI de jure includes regulations, taxes, and tariffs on trade as well as trade agreements. On the other hand, FGI de facto includes variables such as portfolio and foreign direct investments, international debts, reserves, and income payments. The FGI de jure considers investment restrictions, capital account openness, and international investment agreements.[7]

Given the data available, we could build a data sample of twenty LAC countries from 1971 to 2019. Additionally, it is important to mention that Venezuela does not report data for the variable rent as % of GDP for the period 2015–2019. It was completed by the 3-year moving average method. Finally, it is worth noting that we only consider the variables of V-Dem and KOF databases because they offer the longest time series and allow the construction of the widest sample of countries.[8]

4. Methodology and results

When working with cross-country panel data there are several issues to consider. First, the cross-sectional dependence (CSD) problem will probably arise due to the common global shocks which might have heterogeneous effects across countries causing CSD. Secondly, when the time dimension of the data is especially large, it is critical to check if the series involved in the model are stationary. If not, it is necessary to identify the order of integration, e.g., I(1). Thirdly, whether the variables in the model are I(1), it is essential to verify cointegration.

Testing cointegration among the variables in the model is crucial for the consistency of the parameters. As Pedroni (2019, p. 257) has pointed out: "… the presence of cointegration brings with it a form of robustness to many of the classic empirical problems that lead to the so-called violation of exogeneity condition for the regressors. Obvious examples include omitted variables, measurement error, simultaneity, reverse causality or anything that leads the data generating process …"

Fourthly, it is also important to consider the potential endogeneity problem in our model. Endogeneity can be due to three main causes: a) omitted variables correlated with both dependent and independent variables, b) reverse causality, which occurs when the dependent variable determines the explanatory variable, and c) measurement error in the variables. Endogeneity is an issue when we include institutions, regulations, and other similar variables in the model (Owen, 2017).

The techniques used for dealing with endogeneity require using instrumental variables. An instrumental variable can be selected from an external or an internal source. The first option is to select variables that are external to the model. The difficulty with this method is that these sorts of variables are frequently weak instruments and many of them can be endogenous as well. Moreover, it needs strong theoretical/empirical arguments and the situation is more difficult when we deal with more than one endogenous variable. The second option consists of selecting the instruments from variables in the model, i.e., internal instruments.

Given the new advances in this last area, we propose the novel instrumental variable (IV) technique put forward by Norkute et al. (2021) and Cui et al. (2022) for estimating panel IV regressions with unobserved common factors, which is an alternative, specially designed for panel data models with large T. This estimator solves the potential biases caused by endogenous regressors, namely incidental parameters or 'Nickell' bias. It also accounts for CSD (Hailemariam et al., 2022; Wen et al., 2023; Okere et al., 2023; Mary et al., 2023; Cui et al., 2023).

In general, this work considers some initial empirical steps, similar to two recent related works; Dogan et al. (2021) and Liu et al. (2022), and adds up some additional tests available nowadays. Thus, the first step involves checking some properties of the variables, examining cross-sectional dependence, and determining the order of integration of them. The second step is to verify some general conditions of the model being regressed. Thereby, we check for the possibility of structural breaks, slope heterogeneity in the model, and cointegration. Finally, we estimate the long-run parameters of the model.

4.1. Cross-sectional dependence test

For checking CSD we consider the CD-test proposed by Pesaran (2015) where the null hypothesis is weak cross-sectional dependence. The test is robust even in the presence of structural breaks and I (1) variables, as well as for panels with a short T and a large N (Pesaran, 2021). In addition, Chudik et al. (2011) have proposed to identify weak or strong CSD by using a constant alpha, where a value above 0.5 implies a strong CSD. For estimating the exponent of CSD (alpha), we use the bias-adjusted estimator proposed by Bailey et al. (2016), which measures the degree of CSD. The results reported in Table 1 strongly indicate that all the variables are correlated across individuals, i.e., CSD is present. Both the CD-test and the alpha exponent tests indicate a strong CSD problem.[9]

4.2. Unit root test

Once we have unveiled CSD in the variables, we have to move to so-called second-generation panel unit root tests, which allow for the presence of the aforementioned issue. The most popular test in this area is the cross-sectional Im-Pesarn-Shin (CIPS) test, developed by Pesaran (2007). This unit root test is popular because it accounts for CSD and heterogeneity among the units.

The results from the CIPS statics for the variables in level (with constant and constant and trend) and first difference are reported in Table 2. There we can see that the variables are nonstationary and that they become stationary at first differences. Therefore, they are I(1).[10]

4.3. Slope heterogeneity

In order to verify homogeneity in the parameters, we use the tests developed by Bersvendsen and Ditzen (2021). This test is based on

Table 1
Cross-sectional dependence tests. Pesaran (2015).

Variables	CD-test	p-value	alpha
lnrent	29.63	0.000	0.961
lngdppc	56.89	0.000	0.969
Prights	39.58	0.000	0.950
Corrupt	22.91	0.000	0.883
Trade	63.92	0.000	1.003
Financial	60.07	0.000	0.985

[6] In this field, the KOF Globalisation indexes have been used recently by Alvarado et al. (2021), Aladejare (2022) and Musibau et al. (2022) among others.

[7] See Gygli et al. (2019) for further details.

[8] The countries included are; Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Trinidad and Tobago, Uruguay and Venezuela, RB.

[9] All these analyses were conducted by the new command xtcse2 for Stata® developed by Ditzen (2018, 2021).

[10] The tests were conducted by the command pescadf for Stata® developed by Lewandowski (2006).

Table 2
Unit root tests. Pesaran (2007). CIPS tests.

	Level			Level + trend			1st Differences		
Variables	Lags	CIPS	p-value	Lags	CIPS	p-value	Lags	CIPS	p-value
lnrent	2	−0.389	0.349	4	−0.717	0.237	1	−15.390	0.000
lngdppc	1	0.770	0.779	2	−0.816	0.207	1	−10.449	0.000
Pright	0	−0.153	0.439	0	2.133	0.984	1	−10.687	0.000
Corrupt	4	−1.280	0.100	2	−1.043	0.149	1	−12.214	0.000
Trade	8	−1.477	0.070	3	−1.510	0.125	1	−15.251	0.000
Financial	6	−0.410	0.341	1	−0.206	0.418	1	−14.499	0.000

Pesaran and Yamagata (2008) since it compares the distance between coefficients obtained by a pooled FEs regression and by a cross-sectional unit-specific regression. In other words, it tests the null hypothesis that parameters are homogeneous across cross-sectional units versus the alternative, which states that parameters are heterogeneous.

We will also take into account heteroskedasticity and autocorrelation by estimating HAC robust standard errors (Blomquist and Westerlund, 2013, 2016). In this case, the quadratic spectral kernel was selected, and the bandwidth was automatically selected by Newey and West's method (Newey and West, 1994). In addition, it is very important to control for CSD, therefore, we implement the extension developed by Bersvendsen and Ditzen (2021) based on Chudik and Pesaran (2015) who proposed controlling for CSD by approximating the common factors by cross-sectional averages (CSA).

This approach is based on the common correlated effects (CCE) estimator of Pesaran (2006). Furthermore, to account for the dynamics in the CSD we will follow Chudik and Pesaran (2015) who recommended that the number of lags of the CSA should be in the region of $T^{1/3}$. In our case, with T = 49, it is 3.65 lags, i.e., between 3 and 4. We have imposed 3 lags in our estimation. The results reported in Table 3 confirm the null hypothesis of slope coefficient homogeneity.[11]

4.4. Structural breaks tests

Verifying the possibility of structural breaks in the model is crucial in long panels since the likelihood that some disruptive events will produce changes in the model parameters is high. For this purpose, we use the method for panel data developed by Karavias et al. (2022) and Ditzen et al. (2021). This method has several advantages. For instance, it allows the detection of several structural breaks at unknown points. This test can also be used in the presence of strong CSD, correlation, and heteroskedasticity.[12]

In the specification to calculate the variance–covariance matrix, we have chosen the non-parametric estimator of Pesaran (2006). We augmented the model with the cross-section average of the variables in the model to control for strong CSD. Besides, we have determined the number of breaks using the sequential testing approach described in Ditzen et al. (2021, section 3.1). In addition, the maximum number of possible breaks is determined by the minimal periods allowed between two breaks, and it is controlled by the 'trimming parameter'.

The test allows us to verify three main hypotheses, but following the recommendation of Bai and Perron (2003), we start testing the null hypothesis of no breaks against the alternative of up to the maximum breaks possible given the trimming chosen, i. e., testing no break against the possibility of some breaks between one up to the maximum. Following this procedure, we will test two models with two different segmentations: Model 1 tests structural change in the variables with fixed effects, i.e., it considers only structural changes in the parameters of the model. The second model allows for structural changes in the fixed effects and the parameters. Each model is tested by setting a trimming of 15% and 10%.[13]

As we can see in Tables 4 and 5, we find no evidence of structural breaks for Model 1 or Model 2. In other words, there is no evidence of a structural break in either the parameters or the fixed effects of the model.

4.5. Cointegration

We implement the test proposed by Westerlund (2007), which has the advantage of not imposing any common-factor restriction. Thus, it allows for heterogeneity in the long-run cointegrating relationship and the short-run dynamics, as well as CSD. The general null hypothesis is that the panel is not cointegrated.

The estimation is based on a parsimonious model without deterministic terms, which includes only one lag and one lead to avoid loss of power due to overparameterization. The width of the Bartlett kernel window (bandwidth) was approximated by the rule of thumb $4\times(T/100)^{(2/9)}$ which is, for our dataset, between 3 and 4. We have set it to 4, although with 3 we got similar results. Additionally, as we have shown, the presence of CSD is strong. For this reason, we added to the report the robust critical values by applying the bootstrap approach to the error-correction test proposed by Westerlund (2007) with 400 replications. The results are reported in Table 6. These show that by taking into account the CSD problem, the tests reject the null hypothesis of no cointegration in all cases at standard levels of confidence. Hence, we have

Table 3
Slope homogeneity test. Bersvendsen and Ditzen (2021).

	Statistics	Statistics adj.
Delta (HAC)	1.342	1.625
p-value	0.18	0.104

Notes: Kernel: quadratic spectral. Average bandwidth: 4. CSA variables: lnrent lngdppc Prights Corrupt Trade Financial.

Table 4
Structural break tests. Ditzen et al. (2021). Trimming at 15%.

Number of breaks	Model 1	Model 2	1%	5%	10%
F (1/0)	0.16	0.56	4.48	3.65	3.23
F (2/1)	0.18	0.25	4.88	3.98	3.63
F (3/2)	0.13	0.53	5.11	4.2	3.82
F (4/3)	1.24	3.27	5.23	4.34	3.97
F (5/4)	0.03	0	5.31	4.47	4.1

Bai and Perron (1998) critical values: ***, ** and * denote statistical significance at 1%, 5% and 10% respectively.

[11] We use the new command xthst for Stata® developed by Bersvendsen and Ditzen (2021). The specification is xthst varlist, cr(varlist, cr_lags(3)) hac kernel (qs) bw(4).

[12] For these tests we use the new command xtbreak for Stata® developed by Ditzen et al. (2021).

[13] The general specifications for the results reported in Table 3 are: "xtbreak test varlist, h(2) trimming(0.10 or 0.15) csa(varlist) vce(np) sequential" (model 1). For model 2 it is added "breakfixedeffects".

Table 5
Structural break tests. Ditzen et al. (2021). Trimming at 10%.

Number of breaks	Model 1	Model 2	1%	5%	10%
F (1/0)	0.16	0.56	4.62	3.74	3.33
F (2/1)	0.18	0.25	5.03	4.11	3.72
F (3/2)	0.13	0.53	5.16	4.32	3.95
F (4/3)	1.24	3.27	5.26	4.51	4.09
F (5/4)	1.76	3.93	5.32	4.6	4.21
F (6/5)	0.58	0	5.39	4.73	4.31

Bai and Perron (1998) critical values: ***, ** and * denote statistical significance at 1%, 5% and 10% respectively.

Table 6
Cointegration tests. Westerlund (2007).

Statistic	Value	Z-value	P-value	Robust P-value
Gt	−2.89	3.04	0.001	0.003
Ga	−9.689	1.19	0.882	0.018
Pt	−10.452	1.67	0.048	0.048
Pa	−8.86	0.47	0.321	0.043

strong evidence of cointegration among the variables in the model.[14]

4.6. Estimation of the long-run relationship

For estimating the long-run relationship, we add country and time fixed effects to the general equation (1), i.e., we estimate a two-way fixed effects (FE) error component model. The cross-country FE will allow us to control for some fixed country-idiosyncratic factors. The time-varying FE will help us to control for factors such as technological progress and external shocks.

Given the CSD problem, two estimators can be considered; Park's Feasible Generalized Least Squares (FGLS) proposed by Parks (1967), and Panel Corrected Standard Errors technique (PCSE) proposed by Beck and Katz (1995). However, FGLS obtains better results than the PCSE when the time dimension is one and a half times larger than the cross-section dimension. In our sample, it is T/N = 2.45 (Chen et al., 2010; Reed and Ye, 2011; Moundigbaye et al., 2018). In general, the FGLS estimator is more efficient than OLS (Bai et al., 2021) and PCSE when working with this structure of data (Reed and Ye, 2011; Moundigbaye et al., 2018).[15]

Finally, we have considered a new IV approach put forward by Norkute et al. (2021) and Cui et al. (2022). These authors proposed a new two-stage instrumental-variables (2SIV) estimator which constructs instruments from defactored covariates. As Kripfganz and Sarafidis (2021) have pointed out, this approach combines features from both the common correlated effects (CCE) estimator of Pesaran (2006) and the iterative principal components (IPC) estimator of Bai (2009).

The 2SIV is a better alternative to CCE and IPC for several reasons. Some of its advantages are: a) it is valid for either heterogeneous or homogeneous slope coefficient models, b) unlike CCE and IPC, 2SIV does not suffer from incidental parameter bias, therefore it does not require bias correction to ensure that inference remains valid asymptotically, c) while CCE requires to meet the rank condition, 2SIV does not since the factors are obtained by principal component analysis (PCA), d) it is also robust since the objective function is linear in the parameters, e) it allows to control for endogeneity with a flexible specification of instruments (Kripfganz and Sarafidis, 2021).

In our 2SIV estimation, we have assumed homogeneous slope coefficients, an assumption that was validated in section 4.3. We have used one lag of 'lngdppc' and the other four explanatory variables as defactored instruments, extracting factors jointly from the matrix of all covariates and using the option 'doubledefact'. To compute the number of factors to be included, we employed the eigenvalue ratio test proposed by Ahn and Horenstein (2013), imposing a maximum of twelve factors. In Table 7 we present the results of the two estimators (FGLS and 2SIV). We consider the former estimator as a benchmark, and our analysis will be based on this last one.[16]

As we can see, all the parameters estimated are statistically significant at the standard levels of 1% and 5%. In addition, the p-value of 0.36 obtained by the Hansen test confirms the null, i.e., that the overidentifying restrictions are valid in the 2SIV estimator. This finding is crucial since it confirms the exogeneity of the defactored covariates regarding the idiosyncratic error. In other words, the instruments are valid. Moreover, since the orthogonality condition of instruments is violated when the slope vector is cross-sectionally heterogeneous, the acceptance of the null becomes additional proof of the slope's homogeneity (Kripfganz and Sarafidis, 2021). The estimated number of factors in the first stage is 1 and 8 for the second stage. Finally, the Pesaran (2015) test confirms the weak CSD hypothesis at a level of significance of 10%, i.e., CSD is not a concern in this estimation.[17]

5. Discussion

The income elasticity (lngdppc) shows a positive impact on the rent. This finding is consistent with the results of Ben-Salha et al. (2021) and Canh et al. (2020), although the former study found a bidirectional long-run causality between economic growth and rents. In addition, the elasticity is estimated at 0.8, which is close to the 0.92 value estimated by Dogan et al. (2021) for the middle quantile of their quantile regression estimations, which is middle rent countries. Thereby, this evidence shows that economic growth in the LAC region boosts the rentability of this industry. This positive impact demonstrates the relevance of local demand and the effects of improvements in infrastructure, efficiency, and productivity associated with the investment flow that economic growth promotes. Finally, as Liu et al. (2022) have pointed out, economic growth could be an important factor in reducing natural resource rent volatility and enhancing a more stable path of growth.

Regarding the institutional variables, property rights and corruption, we have got two riveting results. First off, the positive and statistically significant slope estimated for property rights is in line with the findings of Cust and Harding (2020) and with the behavior predicted by the

Table 7
Lon-run estimations: FGLS and 2SIV. Dependent variable: lnrent.

	FGLS		2SIV*	
Variables	Coef.	p-value	Coef.	p-value
lngdppc	0.859	0.000	0.795	0.000
Pright	0.004	0.031	0.002	0.021
Corrupt	−0.005	0.002	−0.005	0.000
Trade	0.016	0.000	0.008	0.000
Financial	0.016	0.000	0.024	0.000
Intercept	0.725	0.157	−2.464	0.006

*Hansen test. H0: overidentifying restrictions are valid => chi2(13) = 10.999, P-value = 0.3576. Number of instruments: 15. Number of factors: in X = 1, in u = 8.
Pesaran (2015) H0: errors are weakly => CSD CD = 1.643, P-value = 0.100.

[14] For the estimations we used the command xtwest for Stata® developed by Persyn and Westerlund (2008).
[15] We used the standard command xtgls from Stata®, specifying a heteroskedastic error structure with cross-sectional correlation, and panel-specific AR1 autocorrelation structure calculated by time-series autocorrelation method.
[16] We used the new command xtivdfreg for Stata® developed by Kripfganz and Sarafidis (2021).
[17] The Pesaran (2015) test was run by the command xtcd2 for Stata® developed by Ditzen (2018).

model of Bohn and Deacon (2000) for capital-intensive industries, who have pointed out that risk on property rights would reduce investments. In this context, investors would not be willing to conduct new investments, which would reduce the rate of exploitation of resources until conditions change. It would raise the costs of extraction and reduce production, which will affect rents.

In addition, since property rights insecurity is often accompanied by strong political instability, a negative effect can trigger a downward spiral in investment, production, and rents (Bohn and Deacon, 2000; Cust and Harding, 2020). Even more, if the situation is severe, it can drive off investments even when the rate of return is high (Shleifer and Wolfenzon, 2002). These effects have been empirically recognized as being especially important in the non-renewable natural resource industry given the high risk of this sort of investment since it involves sunk costs and a sizeable amount of irreversible investments which are subject to the risk of expropriation (Bohn and Deacon, 2000; Stroebel and van Benthem, 2013; Cust and Harding, 2020).

On the other hand, we got the opposite effect from corruption, i.e., a negative statistically significant coefficient. Our results warn about the impacts of these behaviors and the need to fight corruption. Essentially, corruption discourages not only national investments but also FDI (Busse and Hefeker, 2007; Al-Sadig, 2009; Mathur and Singh, 2013), which affects innovation and productivity (Sachs and Warner, 2001; Mehlum et al., 2006). For example, it has been shown that an increasing structure of corruption discourages both national and foreign direct investments (Busse and Hefeker, 2007; Al-Sadig, 2009; Mathur and Singh, 2013). It also affects innovation and productivity (Sachs and Warner, 2001; Mehlum et al., 2006).

All these produce a relocation of talent, technology, and capital away from their most productive uses (Murphy et al., 1991, 1993; Shleifer and Vishny, 1993; Gamberoni et al., 2016). Therefore, the sectoral rent will be negatively affected by reducing the marginal gains from capital (Dissou and Yakaustava, 2012). Moreover, these practices can even take hold, generating monopolistic structures, limiting competition, and increasing inefficiency.

One last point regarding the institutional variables is noteworthy. Our results reject the two hypotheses stated by de Soysa et al. (2022) for LAC countries. These hypotheses indicate that concentrated interest groups acting in this sector prefer to keep property rights insecure for their benefit and that they stimulate patronage and political corruption. Thus, since the interests of these groups would be to raise their rents, it would be expected that property rights would harm rents and corruption would have a positive effect on rents; otherwise, these groups would not promote this sort of institutional framework.

However, we have found the opposite sign in both variables, therefore, this influence is not present in LAC countries, and the hypotheses would not be valid for this region. Moreover, our result contradicts the findings of Urbina and Rodríguez (2021), who found evidence in favor of the 'grease the wheel hypothesis' for some Latin American countries.

Regarding policy variables, our findings strongly support the hypothesis that outward market orientation has a positive effect on non-renewable natural resource endowments. Both the opening of trade and capital accounts depict positive and statistically significant impacts on rents. These results are in line with Arezki et al. (2019), who have also pointed out that this opening policy would explain the boom of natural resource discoveries in Latin America during the period of opening policies.

A trade opening policy promotes integration into the world trade flow, enhancing the economy's ability to compete in the international market, which can benefit the economy in both export and import development. Generally, a trade and financial opening policy are important drivers of technology transfer and other technical skills that improve the efficiency and productivity of these economies (Poelhekke and van der Ploeg, 2013; Le Clech, 2023; Le Clech and Guevara-Pérez, 2023), especially in non-renewable resource industry (Majumder et al., 2020). In addition, capital account opening can promote FDI which is an important driver for natural resource rents (Ndikumana and Sarr, 2019; Zafar et al., 2019; Asif et al., 2020; Canh et al., 2020). Especially, in the LAC region, FDI is a key determinant of natural resource production and an important promotor of economic growth (Zeeshan et al., 2020).

Besides all those advantages, globalization can also bring other benefits. In this line, Wang et al. (2023a) have shown that both higher natural resource rents and lower corruption raise the likelihood of getting a positive impact of trade openness on the environment quality. Although Wang et al. (2023d) have shown that trade openness has mitigated carbon emissions in only a few countries. The specific evidence for the LAC economies shows that globalization reduced the ecological footprint (Alvarado et al., 2021; Jahanger et al., 2022).

However, the effect on the environment is dependent on the level of economic development of the economies, as Alvarado et al. (2021) have demonstrated, in high-income LAC countries, natural resource rents lead to a reduction of the ecological footprint. On the other hand, in upper-middle and lower-middle-income countries, the relationship is inverse. These findings are in line with those of Wang et al. (2023a). Therefore, it could be argued that it is probable that as income and natural resource rent increase, the effect on the environment turns out to be positive or, at least, neutral in the LAC region. For that reason, it is important to promote resource rent gains by reducing property rights uncertainty and corruption levels, as well as fostering openness policies.

In general, despite some controversy, it can be concluded that being part of economic globalization can be crucial for this region in many aspects. (Balza and Espinasa, 2015; Zaidi et al., 2019; Xiaoman et al., 2021).

6. Conclusion and policy recommendations

This study was inspired by that of Arezki et al. (2019), who claimed that natural resource endowment is not exogenous. Moreover, it depends on the quality of institutions and the openness of policies. Thus, we have investigated the relationship between two institutional variables (property rights and corruption) and two outward-oriented policies (trade and capital account openness) regarding the non-renewable natural resource rents in Latin America and the Caribbean. We have also included the national income, measured by the gross domestic product per capita, as an additional control variable. Our research, like that of Arezki et al. (2019), confirms that the analysis of causality from institutions and policies to natural resources is also relevant.

In this way, our study attempted to explore the long-run relationship between these variables, identifying their effect on non-renewable resource rents. The methodology strategy followed included; checking for cross-sectional dependence and the order of integration of the variables. Also, we have verified the coefficients' slope homogeneity and the possibility of structural breaks was discarded. Finally, after verifying the cointegration between the variables, which confirms a long-run relationship of the model, we have estimated the long-run parameters by two techniques; Park's Feasible Generalized Least Squares and a new instrumental variable approach put forward by Norkute et al. (2021) and Cui et al. (2022).

Our results indicate that better property rights boost non-renewable natural resource rents. In contrast, corruption affects negatively the rents of this industry. This is an important finding since countries with weak rules of law raise the transaction cost, and high political volatility and governance deficiencies reinforce the situation. Corruption increases the demand for secrecy and can encourage bureaucrats to endorse inefficient companies, preventing more competent companies from entering. This would reduce innovation causing the relocation of talent, technology, and capital towards less productive uses.

Regarding the outward-oriented policies, we have found that the openness of both trade and financial accounts positively impacts the rent of this sector. These findings are in line with those of Arezki et al. (2019), who have confirmed that economic liberalization is a key determinant of discoveries and extractive activities. Our results validate the same effect

on the rents of this industry for the LAC region.

In general, our findings are consistent with some other works, such as Cust and Harding (2020), who found a strong relationship between institutional quality and investment in oil exploration, discovery, and development; Liu et al. (2022), who highlighted the crucial role that good governance and globalization have on natural resource prices; and Arezki et al. (2019), who posited the hypothesis that outward market orientation has a positive effect on non-renewable natural resource endowments. We have also found evidence in favor of the 'sand in the wheel hypothesis' and against the NRCH on property rights. Indeed, these results contradict the findings of Urbina and Rodríguez (2021) and override, in the case of the LAC region, the NRCH hypothesis postulated by de Soysa et al. (2022).

Given the evidence gathered by this research, the policy recommendations that we can posit are in line with some other studies. In general, it would be important that several countries in the region forsake those old policies inspired by the import substitution industrialization ideas. Those policies of ownership intervention or even expropriation, or the obstacles or the direct prohibition on importing foreign capital, expertise, or technology, have normally stunted the development of this industry. In other words, the key is good governance and economic freedom (Frankel, 2012; Arezki et al., 2016; Arezki et al., 2019; Azam, 2022).

Therefore, LAC countries need to reduce policy uncertainty, which can be achieved by implementing stable policies and regulations that allow for a glimpse of a long-term horizon. In addition, in line with the findings of Liu et al. (2022), it would be advisable to reduce the restrictions on the capital account and promote an economy that is open to international trade, which will result in a decrease in the characteristic volatility of the sector. In other words, these countries should tend to ease bureaucratic red tape, reduce corruption by augmenting transparency, reach greater political stability, and implement much more responsible macroeconomic policies.

In sum, both institutional improvements and open policies have several benefits. For instance, they have the potential to reverse the effects of the natural resource curse (Boschini et al., 2007; van der Ploeg, 2011; Haber and Menaldo, 2012; Majumder et al., 2020). Moreover, our findings have shown that improvements in the security of property rights and the reduction of corruption, as well as a policy of economic openness, improve the rent obtained from the exploitation of these resources, which in turn has a positive effect on other areas, such as economic growth (Kristjanpoller et al., 2016; Le and Bao, 2019; Zeeshan et al., 2020), productivity (Le Clech, 2023; Le Clech and Guevara-Pérez, 2023), tax revenue (Lopez-Murphy and Villafuerte, 2010; Alvarado et al., 2022) or the accumulation of physical and human capital (Blanco and Grier, 2012; Le Clech et al., 2023). Even more, given the findings of Wang et al. (2023a), Alvarado et al. (2021), and Jahanger et al. (2022) for LAC economies, it should be expected that a high level of natural resource rents, combined with institutional quality improvements and openness to trade strategy, brings benefits to the environment.

Finally, it is important to point out some limitations of this research which could be also considered by future research. For instance, as we have evaluated a panel sample of countries, the conclusions and recommendations are general. In this line, those studies that carry out a more detailed analysis of the situation of each economy could offer more precise lines of action. It could be also relevant to conduct similar studies based on specific areas included in the natural resources industry.

Another riveting area for further research is implementing quantile regressions and/or estimating the threshold effects. These techniques could offer other answers by identifying the effects according to the level of economic development, for example, or checking if there is some threshold point from which some explanatory variable changes its impact.

Author statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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