Economic Systems 47 (2023) 101059

Contents lists available at ScienceDirect

Economic Systems

journal homepage: www.elsevier.com/locate/ecosys

Oil dependence and entrepreneurship: Non-linear evidence

Paul Awoa Awoa*,[1], Françoise Okah Efogo[2], Henri Atangana Ondoa

University of Yaounde 2, Cameroon.

ARTICLE INFO

JEL classification:
L26
O13

Keywords:
Oil rents
Entrepreneurship
Institutions
Panel threshold regression

ABSTRACT

This study examines the empirical nature of the oil dependence-entrepreneurship nexus, building on recent research that extends the "resource curse" beyond its effects on economic growth. For the period from 2006 to 2018, the sample includes 115 countries at various stages of economic development. Using panel threshold methods, we discover an inverted U-shaped relationship, indicating that even small increases in oil rents increase entrepreneurship below the threshold. Globally, oil rents above a threshold of 77 % stifle entrepreneurship. Regional differences and institutional vulnerability act as moderators.

1. Introduction

Entrepreneurship, i.e. "the capacity for innovation, investment, and activist expansion in new markets, products, and techniques" (Leff, 1979), is a key driver of economic growth and structural change (Baumol, 1968; Gries and Naudé, 2010). Entrepreneurs create new firms and wealth in the global economy by creating new jobs, promoting both efficiency and innovation (Harris et al., 2009). As a result, increased entrepreneurship would imply increased economic growth. Nonetheless, entrepreneurs around the world face a variety of barriers to starting and growing new businesses, particularly in resource-rich countries where unproductive and rent-seeking activities persist due to lax enforcement laws and high bureaucratic barriers (Torvik, 2002; Farhadi et al., 2015; Chambers and Munemo, 2019a; Munemo, 2021). This last observation explains why a recent strand of literature analyses the effects of natural resource dependence on entrepreneurship (Farzanegan, 2014; Chambers and Munemo, 2019a; Munemo, 2021).

The impact of natural resources on entrepreneurship has been studied primarily in the framework of rent-seeking theory (Murphy et al., 1993; Baland and Francois, 2000; Torvik, 2002; Munemo, 2021). According to this idea, natural resource rents, particularly oil and gas, might boost the prospects for entrepreneurship while lowering involvement in productive business (Chambers and Munemo, 2019a). It also refers to resource depletion in order to secure profits from natural resource extraction (Munemo, 2021). As a result, as natural resources become more abundant, opportunistic rather than productive and sustainable entrepreneurship expands (Torvik, 2002; Canh et al., 2020). In addition, Baland and Francois (2000) mention that resources are pulled out of production and reallocated to rent-seeking when the value of an import quota increases more than that of productive goods and services. This leads to

* Corresponding author.
E-mail addresses: paulawoa2010@gmail.com (P.A. Awoa), francie_okah@hotmail.fr (F.O. Efogo), atanganaondoa@yahoo.fr (H.A. Ondoa).
[1] ORCID: https://orcid.org/0000-0001-6165-5316
[2] ORCID: https://orcid.org/0000-0001-7396-3535

https://doi.org/10.1016/j.ecosys.2022.101059
Received 27 January 2022; Received in revised form 12 August 2022; Accepted 18 August 2022
Available online 11 November 2022
0939-3625/

equilibrium with fewer people engaged in entrepreneurial activity. As a result, there may be an asymmetric relationship between natural resources and entrepreneurship.

Following this line of enquiry, empirical studies indicate that natural resources are a malediction for some countries due to rent-seeking, but also a blessing for other countries (Majbouri, 2016; Canh et al., 2020). The mechanics supporting the curse are the following: a natural resource boom increases the number of rent-seekers, lowering the returns of both rent-seeking and productive entrepreneurship, thereby inducing a global decrease in global entrepreneurship (Farzanegan, 2014; Chambers and Munemo, 2019a). The mechanism underlying the benediction effect is as follows: a natural resource boom induces a rise of new businesses that did not exist before, as well as their supply chains; it also increases disposable income, leading to higher demand for products and services. Hence, they boost entrepreneurship (Okkonen and Suhonen, 2010; Majbouri, 2016).

Based on this inconclusive literature, some authors assume that the effect of natural resources could be conditional. They especially identify the governance model, the political regime, and institutional quality as moderator variables. These factors are able to mitigate the negative effects of a natural resource boom and explain the existence of both blessed and damned abundant countries. Other researchers suggest that the relationship is certainly nonlinear. Our paper examines this hypothesis on a sample of 115 countries from 2006 to 2018. However, in contrast to the quadratic specification generally applied to the study of non-linear relationships, we rely on the panel smooth transition regression (PSTR) with instrumental variables proposed by Gonzalez et al. (2005) and Fouquau (2008).

In various aspects, the PSTR differs from classic quadratic or cubic reduced-form models. First, it can anticipate the threshold level and measure the smoothness of transition between regimes endogenously. Second, it addresses endogeneity, which might result from theoretical reverse causation between natural resources and entrepreneurship (Canh et al., 2020, 2021) on the one hand, or measurement error, particularly in entrepreneurship (Chambers and Munemo, 2019a), on the other. Third, it addresses issues such as the cross-country heterogeneity and time unpredictability of the oil dependence-entrepreneurship nexus. Furthermore, the effects of oil rents on entrepreneurship are anticipated to differ by country and period. Unlike most previous literature, it allows for a smooth and continuous transition between regimes.

To the best of our knowledge, this is one of the first studies to employ the PSTR to perform an empirical analysis of the entrepreneurship-natural resources nexus, but its originality extends beyond the tool's technological capabilities. Our study contributes to the body of empirical work on entrepreneurship and natural resources identified by Munemo (2021). It also determines the number of regimes in the relationship, conducts a regional analysis, and investigates the function of institutional vulnerability.

Section 2 follows this introduction by presenting the theoretical mechanism by which natural resources influence entrepreneurship. The data and methodology are described in Section 3. Section 4 contains the results, while Section 5 presents a discussion and conclusion.

2. Theoretical foundation and related literature

First mentioned in the work of the geographer Auty (1994), the resource curse is manifested by low growth in resource-rich countries that contrasts with high growth in resource-poor countries. The idea of the existence of such a curse was later taken up in the work of Sachs and Warner (1995, 2001). Even today, many authors assert (Atangana Ondoa, 2019) and prove (Ali et al., 2020; Awoa Awoa Awoa et al., 2022; Kamguia et al., 2022) that the natural resource curse is a reality. Yet Sala-i-Martin and Subramanian (2008), in addressing the question of the curse, successfully demonstrate that it is not the abundance of resources per se that is a problem, but rather the deleterious policy environment it creates, fostering corruption and squandering. A similar explanation has already been given by Van Der Ploeg (2011). He put forward a more elaborate list of the indirect effects of the abundance of natural resources, namely: appreciation of the real exchange rate, commodity price volatility, Dutch disease, institutional weaknesses, and underdeveloped financial systems. These studies give room to the hypothesis of a conditional or indirect relationship between resource abundance and economic outcomes. In the same vein, they cast doubt on the existence of a systematic negative effect of natural resources on an economy (Shahbaz et al., 2019).

This legitimate doubt is reinforced by the numerous experiences of countries that have escaped the curse through policies aimed at improving the mining sector, prioritizing education, and diversifying economic activity (Ben-Salha et al., 2021). Indeed, developed (Australia, Canada, Great Britain and the United States) as well as some developing countries like Botswana have managed to turn their unsustainable resources into sustainable development (Acemoglu et al., 2003). Moreover, so far empirical works have yielded unconvincing results (Dauvin and Guerreiro, 2017; Badeeb et al., 2017). The ongoing debate has now switched to the effects of natural resources on economic development determinants such as entrepreneurship, which is viewed as one of the largest contributors to economic growth (Baumol, 1968; Leff, 1979; Gries and Naudé, 2010).

From a theoretical perspective, the relationship between natural resources and entrepreneurship is ambiguous (Djimeu and Omgba, 2019; Canh et al., 2020, 2021; Munemo, 2021). Indeed, conventional wisdom suggests that natural resource endowment promotes entrepreneurship by driving demand and production. However, later hypotheses on this issue claim that the evolution of entrepreneurial activity in resource-rich countries depends on the number of entrepreneurs in the economy before the resource boom (Baland and Francois, 2000; Djimeu and Omgba, 2019). Subsequently, evidence from the resource curse indicates that resource abundance has a negative effect on the development of entrepreneurship in resource-rich countries (Chambers and Munemo, 2019a; Munemo, 2021). These different standpoints are based on several mechanisms that have, however, been the subject of few empirical studies.

2.1. The demand channel

The expansion of a natural resource sector creates a supply chain and raises the demand for goods and services. This increase in demand encourages entrepreneurship and resource-related activities. This channel, however, is dependent on the level of entrepreneurship during the boom (Baland and Francois, 2000). Rent increases stimulate domestic entrepreneurship when this level is high. This entrepreneurial class can direct the flow of oil windfalls into the private sector while also absorbing complementary resource boom investments. Specifically, the resource boom encourages higher returns and expands the market size, which potential entrepreneurs can capitalize on by increasing production.

2.2. The rent-seeking channel

According to the "resource curse" hypothesis, profits from oil rents work against productive entrepreneurship. Indeed, when natural resource rents reach the government—whether through taxes or direct income from resource ownership—individuals may see an opportunity to connect with the government in a variety of ways in order to exploit these rents (Murphy et al., 1993). This discourages them from engaging in productive entrepreneurship. Good institutions, on the other hand, can help eliminate or at least reduce this disincentive.

2.3. The institutional channel

In a highly influential article, Baumol (1990) points out that institutions, the rules of the game in a society, impact the split of entrepreneurs between productive, unproductive and harmful activities through the compensation system. According to Acemoglu (1995), when this compensation structure is characterized by high corruption, excessive bureaucracy and low property rights, it always results in talent misallocation. According to Murphy et al. (1993), rent-seeking, particularly by government officials, is likely to impair creative activity more than ordinary manufacturing. Government greed, shown in taxation, theft, bribery and nationalization, dampens entrepreneurship by reducing investment (Lane and Tornell, 1996; Tornell and Lane, 1999). Furthermore, resource disputes can not only impair entrepreneurial incentives but also result in significant crowding out of small existing businesses.

2.4. The initial level of productive entrepreneurs

According to Baland and Francois (2000), natural resources have a negative impact on entrepreneurship only when the number of people engaged in innovation activities is small. On the other hand, if the number of people engaged in rent-seeking activities is high (i.e., the low entrepreneurship rate prior to the boom), the resource boom reduces entrepreneurship because it promotes rent-seeking behaviors even more. Canh et al. (2021) qualify this channel by stating that excessive natural resource rents, rather than the level of entrepreneurship prior to the boom, pose a threat to entrepreneurship.

2.5. The point-source resource hypothesis

Majbourri (2016) also made significant contributions to the empirical literature on the relationship between natural resources and entrepreneurship. In their examination of the entrepreneurship-natural resources nexus, Boschini et al. (2007) recognize the importance of so-called point-source resources. According to Alexeev and Conrad (2011), an oversupply of point-source resources could be harmful to a country's institutions, resulting in a negative impact on growth and long-term factors such as entrepreneurship. This argument is especially pertinent in emerging countries, where poor institutions have frequently been blamed on their wealth in point-source natural resources like oil. Oil provides an average of 80 % of total rent in these countries, making them particularly vulnerable to the resource curse (Farhadi et al., 2015).

Globally, the literature reveals that the relationship between natural resources and entrepreneurship is not linear. It can also differ from one country to the next due to country differences such as the starting amount of entrepreneurship, the initial level of rent-seeking, and institutional quality. Whatever the theory, natural resources are not always a burden. As a result, a non-linear approach to the relationship, correcting for reverse causality, appears to be the preferable way to evaluate the relationship between natural resources and entrepreneurship (Munemo, 2021). Nonetheless, Munemo's empirical technique has some limitations that allow for a fresh investigation with a stronger instrument, as stated in the next section.

3. Empirical framework and preliminary analysis

Theoretical and empirical studies attest to the existence of a relationship between natural resources and entrepreneurship. However, little is done to rigorously investigate the nature of this relationship. This paper attempts to make a significant contribution to this discussion by employing an appropriate empirical strategy, as described below.

3.1. Data issues

For the purpose of our analysis, we compiled data from different World Bank databases. Given the serious lack of global entrepreneurship data, our sample includes 115 countries with varying income levels and spans a 13-year period from 2006 to 2018.

Our sample is made up of 42 high-income countries and 82 developing countries. Because of this heterogeneity, we take a global perspective (whole sample) as well as a categorical approach based on a country's income level. Countries and variables are presented in Tables A.1 and B.1 in Appendices A and B, respectively.

3.1.1. Entrepreneurship data

Due to the complexity of the concept of entrepreneurship, it is important to choose an indicator that fits the research context. In this vein, the literature proposes a set of indicators like innovation, alertness and discovery, as well as judgment (Bjrnskov and Foss, 2008). In this work, we follow Chambers and Munemo (2019a) and use new business density, i.e., "the number of newly registered limited liability corporations per calendar, normalized by population" (World Bank, 2021a). It is an indicator of gross new formal entry that focuses on the introduction of new formal firms and innovation activities that drive creative destruction, following Bjrnskov and Foss (2008). Further, this indicator makes cross-country comparisons easy (Chambers and Munemo, 2019b). Data for the entrepreneurship variable is available in the World Bank's Doing Business database (World Bank, 2021a).

3.1.2. Data on oil dependence

Several indicators are employed in the resource curse literature to quantify natural resource reliance (Dauvin and Guerreiro, 2017), and the mix of outcomes appears to be related to the employed metric. While researchers utilising natural resource exports as a percentage of overall exports validate the resource curse hypothesis, those using output levels or sub-oil assets tend to reject it (Stijns, 2006; Brunnschweiler and Bulte, 2008). We choose oil rent-to-GDP as a proxy for natural resource reliance in this analysis because it represents the instantaneous real macroeconomic contribution of resources and also has a direct impact on households and individual payoffs (Ebeke et al., 2015).

We use this indicator because oil is the measure used most as a point-source resource in the resource curse literature (Alexeev and Conrad, 2011), but less in the relationship with entrepreneurship. Oil also represents more than 80% of the total rent (Farhadi et al., 2015). The data are from the World Development Indicator database (World Bank, 2021b).

3.1.3. Other drivers of entrepreneurship

According to some researchers, a country's progress boosts the number of new enterprises (Djankov et al., 2010). This study implies a reversal of the relationship between entrepreneurship and economic progress (Chambers and Munemo, 2019a). As a result, we control for the effects of the relative economic development level and estimate GDP per capita (GDP, 2010 constant US dollars) as a control variable in our estimation.

In the same manner as Chambers and Munemo (2019a), we see financial development as a driver of entrepreneurship. It is widely acknowledged that financial development is necessary for both business success and economic progress. Furthermore, financial development promotes entrepreneurship by lowering financial credit hurdles for small and medium-sized firms as well as new businesses (Beck and DemirgucKunt, 2006). To capture each country's financial progress, we use domestic credit to the private sector as a percentage of GDP.

We next consider the relationship between trade openness and entrepreneurship. From a theoretical point of view, openness involves not only trade in goods and services but also an exchange of knowledge, which may potentially be important for the development of entrepreneurship (Grossman and Helpman, 1991). Furthermore, learning opportunities emerging from imported knowledge through foreign direct investment, for example, can help laggard firms catch up with new technologies used by foreign and other local competitors (Asongu and Nwachukwu, 2018). This study uses the sum of exports and imports of goods and services as a percentage of GDP as a proxy of trade openness.

3.2. Descriptive statistics and correlation analysis

Table 1 displays the descriptive statistics, while Table 2 shows the correlation matrix of all variables. First, Table 1 proves that entrepreneurship is not a uniformized phenomenon, with a minimum value of 0.006 in Lao PDR in 2008 and a maximum value of 39.039 in Cyprus in 2007. We observe great differences across countries in the density of new business. For the variable oil rents as a percentage of GDP, there is a great country difference as well. We also find a maximum value of oil dependence in Iraq with 64.704% in 2006. This country has a score of 0.25 for new business density in the same year.

In Table 2 we find that the oil rent-to-GDP ratio is negatively and significantly correlated with entrepreneurship. The control variables GDP per capita, credit and trade are positively and significantly related to entrepreneurship. However, these correlation analyses only catch the linear relationship between variables, while non-linear relationships still need to be further investigated.

Table 1
Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Entrepreneurship	1397	3.189	4.159	0.006	39.039
Oil (% GDP)	1490	3.136	8.722	0	64.704
GDP per capita	1490	15,150.92	18,990.04	334.4408	91,964.26
Credit (% GDP)	1370	59.328	46.439	0.497	304.575
Trade (% GDP)	1455	91.464	50.421	0.167	437.326

Table 2
Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)
(1) Entrepreneurship	1.000				
(2) Oil rents (% GDP)	-0.148 ***	1.000			
(3) GDP per capita	0.418 ***	0.026	1.000		
(4) Credit (% GDP)	0.554 ***	-0.186 **	0.669 ***	1.000	
(5) Trade (% of GDP)	0.263 ***	-0.043	0.229 ***	0.179 ***	1.000

Note: *** and ** indicate statistical significance at 1 % and 5 % respectively.

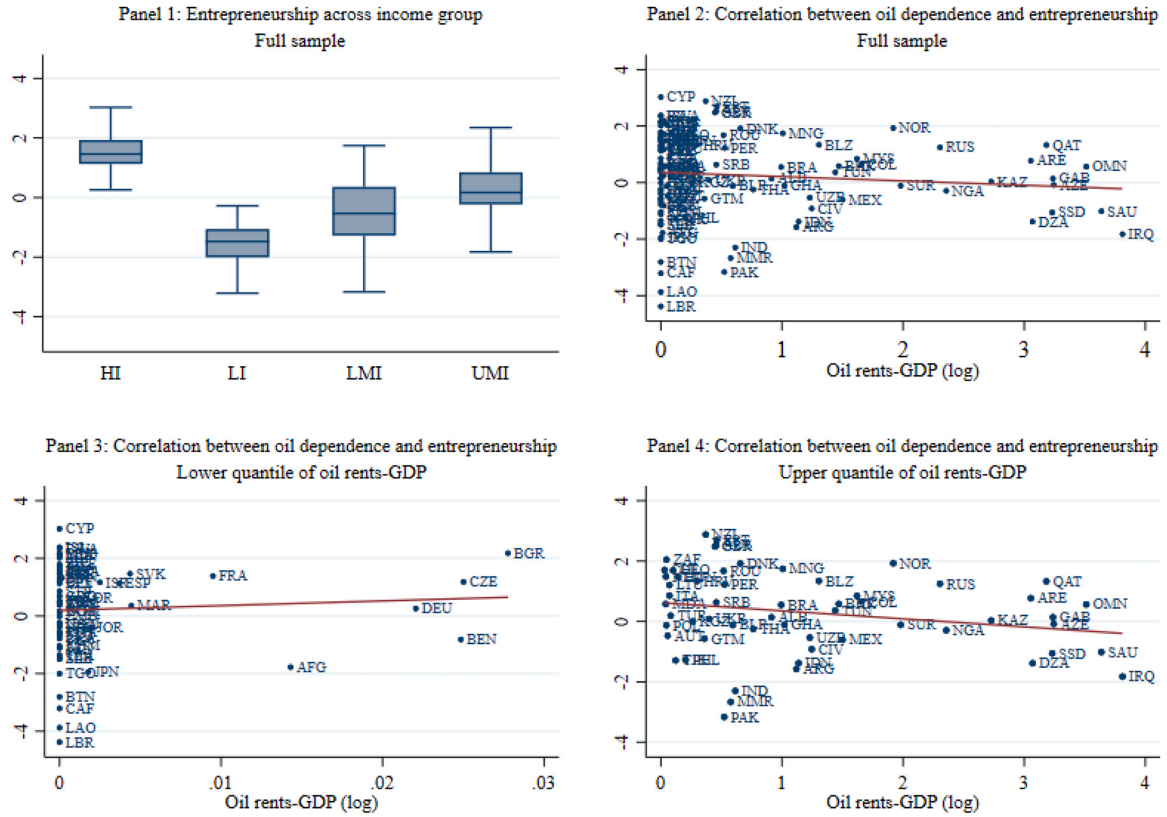

Fig. 1. Entrepreneurship across income group and correlation with oil rents.

Fig. 1 shows box plots and scatter plots as preliminary visual analyses of the relationship between oil dependence and entrepreneurship. Panel 1 depicts the distribution of entrepreneurship across socioeconomic groups. The lower and upper hinges of each box show the 25th and 75th percentiles of the samples, the line in the box the corresponding medians, and the end points of whiskers the next adjacent values. Panels 2, 3 and 4 depict the correlation study of oil rents-to-GDP and entrepreneurship. Panel 2 confirms the negative link between oil rents-to-GDP and entrepreneurship seen in Table 2 of the correlation matrix. However, when we split countries into low and high dependence based on the sample median of the variable oil-to-GDP ratio, we find a positive relationship between oil rents and entrepreneurship in Panel 3 of countries with an oil rents-to-GDP ratio lower than the median, while this correlation becomes negative in Panel 4 of countries with a higher oil rents-to-GDP ratio. In other words, up to a certain point, oil rent encourages entrepreneurship. When this threshold is reached, the relationship turns negative. As a result, this evidence suggests that there is a credible non-linear link between oil rents-to-GDP and entrepreneurship à la Kuznets (1955).

3.3. Model specification

We use the PSTR model to investigate the relationship between oil dependence and entrepreneurship. With this model, we are able to assess the turning point in the relationship between the oil-to-GDP ratio and entrepreneurship. The PSTR model has some advantages compared to other econometric tools used in previous studies. First, it enables us to consider both the heterogeneity and asymmetric responses of entrepreneurship at the level of oil dependence. Second, it considers both time series and panel data dimensions, thereby providing more consistent estimators. Third, PSTR modeling enables a smooth rather than an abrupt transition between extreme regimes, which is a more flexible and reliable framework (Gonzalez et al., 2005). This smoothness assumption is particularly justified by the fact that the impact of oil dependence on entrepreneurship depends on several country characteristics, such as institutions, for which any further change cannot be brutal. Finally, it also offers the possibility of considering more than two regimes, which helps capture different market states induced by oil.

Notes: Entrepreneurship (log) on the y-axis is defined as the rate of new business density (new registrations per 1000 people aged 15–64). In the box plots of Panel 1, the lower and upper hinges of each box display the 25th and 75th percentiles of the samples, the line in the box indicates the respective medians, and the end-points of whiskers mark the next adjacent values. HI: High Income countries, LI: Low Income countries, LMI: Lower Middle-Income countries, UMI: Upper Middle-Income countries.

Source: Authors' calculations using the World Bank's World Development Indicator and Doing Business databases.

Formally, a two-regime PSTR model corresponds to:

$$entrepreneurship_{i,t} = \alpha_i + \beta_0 oil_{i,t} + \beta_1 oil_{i,t} g(q_{i,t}; \gamma, c) + \varphi' X_{i,t} + \varepsilon_{i,t} \quad (1)$$

with $entrepreneurship_{i,t}$ representing the dependent variable (natural logarithm of new business density); $oil_{i,t}$ is the threshold variable, $X_{i,t}$ is a vector containing all control variables. The subscript *i* denotes a particular country, whereas subscript *t* represents a particular time period. α_i is the individual fixed effect and $\varepsilon_{i,t}$represents the error term.

In Eq. 1, $g(q_{i,t}; \gamma, c)$ is the continuous transition function defined and dependent on the threshold candidate variable $q_{i,t}$ ranging from 0 to 1. For a given $q_{i,t}$, the elasticity of entrepreneurship with respect to the oil dependence for country *i* at time *t* is represented as $\beta_0 + \beta_1 g(q_{i,t}; \gamma, c)$.

Following Granger and Teräsvirta (1993), Gonzalez et al. (2005) normally assume a logistic form to determine the transition function as follows:

$$g(q_{i,t}; \gamma, c) = \quad (2)$$

where $\gamma > 0$, $c_1 < c_2 < \ldots < c_m$ is the m-dimension vector to measure the parameters at the transition point, and γ determines the smoothness of the transition. In practical application, m is in general set to be 1 or 2 to capture the non-linearities due to regime switching (Wen et al., 2018). According to Béreau et al. (2010), $m = 1$ refers to a logistic PSTR model, whereas a logistic quadratic PSTR specification is for $m = 2$. When $\gamma \to \infty$, the transition function $g(q_{i,t}; \gamma; c)$ tends to be an indicator function, that is $g(q_{i,t}; \gamma; c) = 0$ if $q_{i,t} < c$ and $g(q_{i,t}; \gamma; c) = 1$ when $q_{i,t} \geq c$. However, when $\gamma \to 0$, the transition function $g(q_{i,t}; \gamma; c)$ is constant, and the model collapses into a homogenous or linear panel regression model with fixed effects.

The order of the transition function affects the transition between regimes. To ensure the necessary variations of slope coefficients for most non-linear analyses, Gonzalez et al. (2005) assume that $m = 1$ for a first order of transition function and $m = 2$ for a second order.

Furthermore, they developed a more general setting for the PSTR model as follows:

$$entrepreneurship_{i,t} = \alpha_i + \beta_0' X_{i,t} + \sum_j^r \beta_j' X_{i,t} g_j(q_{i,t}^j; \gamma_j, c_j) + \varepsilon_{i,t} \quad (3)$$

where g_j is the j^{th} transition function with $j = 1 \ldots r$ the number of thresholds. For all j, when $m = 1$, $q_{i,t}^j = q_{i,t}$, and $\gamma \to \infty$, Eq. 3 represents a classical PSTR model with $r + 1$ regimes. It can especially be treated as a diagnosis test to identify the remaining heterogeneity. When $g_j(q_{i,t}^j; \gamma_j, c_j)$ transits smoothly from 0 to 1, it means that the PSTR model transits between the low regime $gj(g_{i,t}^j; \gamma j; cj) = 0$ and high regime $gj(g_{i,t}^j; \gamma j; cj) = 1$. In this paper, it means that different levels of oil rents as a percentage of GDP correspond to different levels of entrepreneurship development. Oil dependence therefore exerts a non-linear influence on new business density.

The PSTR method is performed in four stages: examining the stationarity of the variable, testing linearity, determining the number of regimes (r) and estimation (Fouquau, 2008). The linearity of the model is tested by the null hypothesis $\gamma = 0$ against the alternative hypothesis, which corresponds to the PSTR model. At this stage, rejection of the null hypothesis requires the use of the PSTR model. The null hypothesis $r = r = 1$ is tested against the alternative hypothesis $r = r + 1$: If the null hypothesis is accepted, the process is ended. However, the stage of determining the number of regimes continues until the first acceptance of the null hypothesis. The final stage of the PSTR analysis is the estimation of the PSTR model. To the best of our knowledge, previous works on the natural resource curse have never investigated non-linearity using the PSTR model in the oil dependence-entrepreneurship relationship.

4. Results

Tables and graphs in the remainder of this paper present results on the impact of oil rents-to-GDP on entrepreneurship as well as

Table 3
Tests for linearity.

	Global sample	Only developing	Middle-Income
Wald test (W)	31.891 ***	26.817 ***	25.345 ***
Fischer test (LMF)	7.405 ***	6.220 ***	5.880 ***
Likelihood ratio (LRT)	32.303 ***	27.251 ***	25.787 ***

Notes: Stars indicate statistical significance at the 1% level.

Table 4
Tests for choosing the PSTR model.

	Global sample	Only developing	Middle-Income
Wald test (W)	8.867 *	4.510	2.113
Fischer test (LMF)	2.007 *	1.007	0.469
Likelihood ratio (LRT)	8.898 *	4.522	2.116

Notes: Stars indicate statistical significance at the 10 % level.

its non-linear relationship.

4.1. Preliminary test and choice of threshold

The preliminary tests are designed to demonstrate the nonlinearity of the relationship between entrepreneurship and natural resource dependence on the one hand, and to determine the number of regimes and transition functions on the other. The results in Tables 3 and 4 support the non-linearity hypothesis for both the overall sample and the sub-samples. Table 4 shows that there are two extreme regimes and that only one transition function is required to capture the data's nonlinear behavior. As a result, our models show a single threshold effect of oil dependence on entrepreneurship. Thus, the relationship can be estimated using the PSTR models with two extreme regimes.

4.2. Results of the non-linear PSTR model

Table 5 displays the empirical findings on the impact of oil dependence on entrepreneurship. Columns (1) and (2) examine the impact of oil rents-to-GDP on entrepreneurship in a global sample of 115 countries, whereas columns (3)-(4) consider only developing countries, and columns (5)-(6) represent middle-income countries (6). The threshold in the global sample is 77.2 %, and a 1 % increase in oil rents-to-GDP will significantly increase entrepreneurship by 12.4 %. A 1 % increase in oil rents-to-GDP above this threshold reduces entrepreneurship by 14.1 %. Furthermore, the thresholds for developing countries and middle-income countries are 65.9% and 65.3 %, respectively. But what differs is the magnitude of the impact of oil dependence on entrepreneurship in each subsample. A 1 % increase in oil rents-to-GDP will significantly increase the level of entrepreneurship by 18.9 % (column 3) and 21.7 % (column 5) in the low regime of developing countries and that of middle-income countries, respectively, while in the high regime of both subsamples, entrepreneurship decreases by 20.5 % (column 4) in developing countries and by 23.1 % in middle-income countries. The slope parameters of the transition functions for the three sample models are small, implying that the transition functions are continuous and smooth (see Fig. 2). This means there is a continuum of conditions between the two regimes – i.e., the impact of oil rents-to-GDP on entrepreneurship smoothly switches from one regime to another.

Source: Authors' construction.

The results from the control variable also highlight some important conclusions for us. The variable GDPpc encourages entrepreneurship in both low and high regimes. This data demonstrates that economic growth always encourages entrepreneurship, regardless of how much the economy depends on oil. In the first regime, credit has a 1 % significant positive influence on entrepreneurship, whereas in the second, it has a 1 % significant negative affect. The resource curse theory concurs with this evidence. Indeed, a number of empirical studies have discovered that resource-dependent nations have weaker levels of political and economic institutions, which restricts their ability to build their economies (Bhattacharyya and Hodler, 2014; Sun et al., 2020). Thus, when oil dependence increases and exceeds the threshold level, the credits granted to the development of new enterprises decrease, considerably reducing entrepreneurship. Finally, we find clear evidence that trade openness is a catalyst of entrepreneurship in the first

Table 5
Estimated results of the PSTR model.

Sample	Global sample		Only developing		Middle-Income	
Regime	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
Oil rents-to-GDP	0.124 **	-0.141 **	0.189 **	-0.205 **	0.217 ***	-0.231 ***
	(0.081)	(0.080)	(0.116)	(0.116)	(0.122)	(0.121)
GDPpc	1.451 ***	0.369 ***	1.179 ***	0.453 ***	1.241 ***	0.497 ***
	(0.095)	(0.055)	(0.127)	(0.073)	(0.137)	(0.078)
Credit	0.469 ***	-0.662 ***	0.662 ***	-0.794 ***	0.654 ***	-0.870 ***
	(0.054)	(0.087)	(0.083)	(0.114)	(0.086)	(0.122)
Trade	0.335 ***	-0.098	0.339 ***	-0.115	0.374 ***	-0.135
	(0.071)	(0.073)	(0.094)	(0.099)	(0.101)	(0.105)
Slope	9.689		7.860		7.989	
Threshold	**77.2 %**		**65.9 %**		**65.3 %**	

Notes: The global sample includes 115 countries, samples of developing countries and middle-income countries (excluding all high-income countries) include 82 and 73 countries respectively. Stars indicate statistical significance at the 10%, 5%, and 1% levels. Heteroscedasticity-robust standard errors are in parentheses.

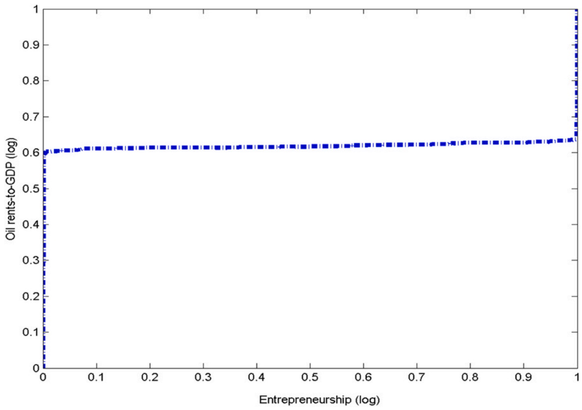

Fig. 2. Transition function with the global sample.

regime at the 5% level in each sample, but not in the second regime, indicating that trade openness promotes entrepreneurship only when the scale of oil rents-to-GDP is low.

From a theoretical perspective, our results are consistent with the resource curse literature, and particularly with the findings of Chambers and Munemo (2019a). These authors assess the effects of total natural resource rents (the sum of oil rents, natural gas rents, coal rents, mineral rents, and forest rents) and find that natural resource extraction limits entrepreneurial activities only in countries with poor governance.

4.3. PSTR robustness

To intuitively capture the advantage of the PSTR model over traditional approaches, we provide a comparative analysis here by estimating a quadratic model with an OLS-FE estimator on the one hand and a dynamic quadratic model with a panel GMM estimator proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) on the other. The GMM model is expressed as follows:

$$\Delta entrepreneurship_{i,t} = \alpha_i + \Delta entrepreneurship_{i,t-1} + \delta_1 oil_{i,t} + \delta_2 oil_{i,t}^2 + \varphi' X_{i,t} + \varepsilon_{i,t} \tag{4}$$

where Δ represents the first difference.

As underlined by Blundell and Bond (1998), the system GMM estimator is more efficient than the first-difference GMM approach, which in a finite sample gives biased results and low precision. To deal with endogeneity concerns due to the reverse causality

Table 6
Estimated panel results.

	OLS-FE	GMM
	(1)	(2)
LAG1		0.933***
		(0.031)
Oil rents-to-GDP	**0.203****	**0.120*****
	(0.091)	(0.036)
Oil rents-to-GDP (sq)	**-0.050****	**-0.060*****
	(0.024)	(0.012)
GDP per capita	0.647***	0.080***
	(0.066)	(0.030)
Credit (log)	0.203***	-0.137**
	(0.047)	(0.062)
Trade (log)	0.196***	0.098***
	(0.032)	(0.024)
Constant	-6.780***	-0.496**
	(0.563)	(0.210)
Threshold	**0.549**	**2.744**
Observations	1180	1161
R-square	0.492	
Countries/Instr.	113	113/24
AR1 (p)		0.000
AR2 (p)		0.509
Hansen (p)		0.396

Notes: Thresholds are calculated as % of GDP. Stars indicate statistical significance at the 10%, 5% and 1% levels. Heteroscedasticity-robust standard errors are in parentheses.

Table 7
PSTR results for the sub-regions.

Sub-region	Africa		America		Asia		Europe & Pacific	
Regime	Low	High	Low	High	Low	High	Low	High
	1	2	3	4	5	6	7	8
Oil rents-to-GDP	**0.517** ***	**-0.517** ***	**6.050** ***	**-6.044** ***	**-0.017**	**-0.141** * **	**0.035**	**-0.049**
	(0.145)	(0.135)	(0.741)	(0.741)	(0.011)	(0.034)	(0.069)	(0.066)
GDPpc	1.626 ***	0.811 **	0.708 *	-0.401	1.011 ***	0.227	1.729 ***	0.407 ***
	(0.398)	(0.377)	(0.369)	(0.252)	(0.220)	(0.240)	(0.188)	(0.059)
Credit	1.473 * **	-1.341 ***	0.267	0.513	0.361 ***	-1.484 * **	0.317 ***	-0.853 ***
	(0.335)	(0.456)	(0.176)	(0.345)	(0.112)	(0.216)	(0.062)	(0.109)
Trade	0.525	-0.542	0.656 **	0.088	0.126 ***	1.865 * **	0.157	-0.054
	(0.363)	(0.735)	(0.311)	(0.342)	(0.037)	(0.449)	(0.141)	(0.061)
Slope	5.771		34.026		0.213		1.967	
Threshold	**0.180**		**0.401**		**0.213**		**0.129**	

Notes: Africa is composed of 28 countries; America of 15 countries, Asia of 33 countries, and Europe and the Pacific of 39 countries. Stars indicate statistical significance at the 10 %, 5 % and 1 % levels. Heteroscedasticity robust standard errors are in parentheses.

between oil rents-to-GDP and entrepreneurship (Baland and Francois, 2000; Canh et al., 2021), one option is to find a strong instrument for the oil rents-to-GDP ratio. However, because pure exogenous instruments that vary across countries and over time are rare, ordinary instrumental variable (IV) estimators may fail to adequately address endogeneity bias (Farhadi et al., 2015). Therefore, the system GMM strategy uses the lagged difference variables for the level series and the lagged levels of endogenous variables for the difference series. In this study, the regressors that are likely to be endogenous are the log of oil rents-to-GDP according to Chambers and Munemo (2019a), international trade as emphasized by Rauch (1996, 1999), and the log of per capita GDP.

Table 6 presents the results of the linear panel and dynamic panel estimates. We display linear panel OLS-FE results in column (1) and the dynamic two-step GMM results in column (2). With those two estimators there is no test for the number of regimes. With the quadratic formula we assume two regimes. In column (2), the results of the p-values of Arellano and Bond's (1991) test for first and second-order autocorrelation ensure that there is no second-order serial correlation. The p-value of the Hansen test of over-identification is not significant, meaning that the instruments are valid. Furthermore, the lagged dependent variable is positive and statistically significant at the 1% level, showing that entrepreneurship is a persistent phenomenon where past values are correlated with current levels of entrepreneurship performances. The results validate the hypothesis of an inverted-U relationship.

4.4. Evidence from the sub-region analysis

To investigate whether the results differ greatly at regional levels, the panel smooth transition regression models are re-estimated at the subsample level. We follow the same strategy as in the global sample and consider the subsamples of 28 African countries, 15 American countries, 33 Asian countries, and 39 European and Pacific countries, respectively. These regions are classified following the *Centre d'Études Prospectives et d'Informations Internationales* (CEPII) and express substantial heterogeneity in resource dependence and economic policies (UNCTAD, 2019). The results of the sub-region estimations are shown in Table 7.

In three sub-regions, the results still confirm the evidence of the inverted U-shape relationship between oil rents-to-GDP and entrepreneurship with two regimes. In Africa and America, oil rents-to-GDP reduces entrepreneurship above the threshold and increases it below the same threshold at 1 %. These results indicate that a low level of oil rents-to-GDP leads to high entrepreneurship, but it can be reduced when the threshold reaches a certain level. In Asian countries, we find a linear relationship. Oil rents-to-GDP has a negative impact on entrepreneurship below and above the threshold, but this negative impact becomes significant above the threshold. In this region, we include Middle Eastern countries characterized by very high levels of oil rents-to-GDP. These results indicate that the oil rents-entrepreneurship nexus does not depend on any threshold of the oil rents-to-GDP ratio, but that the impact is real and noticeable at very high levels of oil dependency (above the threshold). In the European and Pacific regions, we find that oil does not influence entrepreneurship in low or high regimes. This can be explained by the level of structural transformation of countries in this region, but also by the institutional quality.

4.5. Quality of institutions as the threshold variable

Institutions are central to the debate on the resource curse (Menaldo, 2016; Bonet-Morón et al., 2020). According to some authors, resource-rich developing economies generally have poor governance systems and weak institutions. Some argue that these countries' skills, expertise and methods of managing these resources are insufficient (Hartwell, 2016). Adams et al. (2019) recently concluded that globalization fosters the "resource curse" phenomenon, as multinational corporations (MNCs) exacerbate corruption and political instability in resource-rich countries. This subsection examines the role of institutions in the relationship between natural resources and entrepreneurship as a result of these findings.

We use institutional quality as the threshold variable and re-estimate the PSTR models. We measure institutional quality by three main indicators of governance from the World Governance Indicators database provided by the World Bank, namely: control of corruption, regulatory quality, and the rule of law. These indicators of institutional quality are chosen following the literature on the

Table 8
PSTR results with the quality (vulnerability) of institutions as the threshold.

	CC_vul		RQ_vul		RLaw_vul	
Regime	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
Oil rents-to-GDP	**0.094** **	**-0.085** ***	**0.088** *	**-0.063** **	**0.093**	**-0.051**
	(0.045)	(0.024)	(0.046)	(1.154)	(0.031)	(0.021)
GDPpc	1.534 **	0.014	1.528 ***	0.032	1.612	-0.029
	(0.123)	(0.024)	(0.134)	(0.122)	(0.026)	(0.019)
Credit	0.215 ***	0.031	0.213 ***	0.010	0.218	-0.013
	(0.056)	(0.048)	(0.077)	(0.060)	(0.046)	(0.038)
Trade	0.237 ***	-0.068 *	0.253 ***	-0.081 *	0.127	0.064
	(0.044)	(0.041)	(0.029)	(0.048)	(0.045)	(0.028)
Slope	1242.439		42,843,101		64,473,608	
Threshold	**0.850**		**0.807**		**0.460**	

Notes: CC_vul: vulnerability of the control of corruption indicator, RQ_vul: vulnerability of regulatory quality indicator, RLaw_vul: vulnerability of the rule of law indicator. Stars indicate statistical significance at the 10%, 5% and 1% levels. Heteroscedasticity-robust standard errors are in parentheses.

institutional drivers of entrepreneurship (Chambers and Munemo, 2019b).

To build our indicators of institutional quality, we follow the approach of Ebeke et al. (2015), who construct indicators of institutional vulnerability by normalizing and reversing the original indicator of institutions using the following formula:

$$Instvul_{i,t} = \frac{max(Inst_i) - Inst_{i,t}}{max\ (Inst_i) - min\ (Inst_i)} \tag{5}$$

In Eq. 5, min(*Inst*) and max(*Inst*) represent the minimum and maximum of each indicator of institutional quality, respectively. ***Instvuli;t*** ranges between 0 and 1, higher values indicate greater institutional vulnerability. In other words ***Instvuli;t*** increases with the deterioration of the quality of institutions. We check whether institutional quality weakens or strengthens the effects of oil dependence on entrepreneurship. The results are reported in Table 8.

The results from Table 8 corroborate the evidence that, regardless of whether the threshold variable is corruption control, regulatory quality, or the rule of law, a decline in institutional quality is a significant factor in the link between oil rents-to-GDP and entrepreneurship. The enormous magnitudes of each slope parameter point to an abrupt change in regime. The cutoff points for preventing corruption are 0.850, 0.807 for the effectiveness of regulations, and 0.460 for the rule of law. A 1% increase in the oil rents-to-GDP ratio causes a 9.4 % increase in entrepreneurship when the control of corruption vulnerability is less than 0.850 (low regime, column 1 of Table 8), whereas a high regime causes an 8.5 % decline in entrepreneurship. This corresponds to 8.8 % (column 3) and 6.3 % (column 4), 9.3 % (column 5), and 5.1 % (column 6) with regulatory quality vulnerability and rule of law vulnerability as the threshold variables, respectively. In other words, the significance of the negative coefficients of the oil-to-GDP ratio (in high regimes) indicates that the more vulnerable an institution is, the lower is the oil rents-to-GDP encouraging entrepreneurship. These findings support the evidence that the impacts of oil dependence on entrepreneurship are positive when institutional vulnerability is low (good institutions), and turn negative when institutions are highly vulnerable (bad institutions). Hence, our results confirm that the oil curse impedes entrepreneurship when left unchecked by weak institutions.

4.6. Additional evidence from the dynamic panel threshold regression model

We re-examine our threshold estimations with the dynamic panel threshold model proposed by Seo and Shin (2016) as a further robustness check. This novel GMM method extends the traditional panel threshold model (Hansen, 1999; Caner and Hansen, 2004; Kremer et al., 2013) and considers both transitional variables and other covariates as endogenous. Considering the previous evidence of bidirectional causality between natural resource rents and entrepreneurship, this dynamic panel threshold model addresses the inherent endogeneity and simultaneity bias. Seo and Shin (2016) propose a First Difference GMM (FD-GMM) transformation to estimate the coefficients (Seo et al., 2019). Unwinding the assumption of exogeneity on regressors and threshold variables, this algorithm allows the estimators to asymptotically follow a normal distribution. For our purposes, the dynamic panel threshold model is given as:

$$entrep_{i,t} = \rho entrep_{i,t-1} + \alpha_L oil_{i,t} I(q_{i,t} \le \gamma) + \alpha_H oil_{i,t} I(q_{i,t} > \gamma) + \beta' X_{i,t} + \varepsilon_{i,t} \tag{6}$$

In Eq. 6, $q_{i,t}$ and γ are the threshold variable and the hypothetical threshold value, respectively. $I(\cdot)$ is an indicator of the regime. The subscripts L and H on the coefficient α refer to lower and upper regimes, respectively.

In the same spirit as the previous analysis, we first treat oil rents-to-GDP as the threshold variable. Second, institutional vulnerability measured through the composite index of governance constructed with principal component analysis (PCA) is used as a threshold variable. We also separate the threshold effects of the control of corruption vulnerability, the regulatory quality vulnerability, and the rule of law vulnerability. In Seo and Shin's (2016) model, the set of instrumental variables is constructed using the lagged dependent variable, the threshold variable, and other covariates. Table 9 shows the results of the estimations of Eq. 6.

In column (1), the threshold variable is the oil rent-to-GDP ratio. The results show that the coefficient of oil rents-to-GDP is

Table 9
Dynamic panel threshold analysis: Results.

Threshold variable	Oil rents	Gov_vul	CC_vul	RQ_vul	RLAW_vul
	(1)	(2)	(3)	(4)	(5)
Threshold value	**0.534** ***	**0.802** ***	**0.761** ***	**0.373** ***	**0.446** ***
	(0.012)	(0.013)	(0.010)	(0.006)	(0.008)
Oil rents-to-GDP					
Low regime	**0.487** **	**0.125** ***	**0.369** ***	**0.181** ***	**0.149** ***
	(0.239)	(0.033)	(0.031)	(0.036)	(0.048)
High regime	**-0.890** ***	**-0.120** ***	**-0.291** ***	**-0.288** ***	**-0.074** **
	(0.291)	(0.038)	(0.029)	(0.041)	(0.032)
LAG1	0.580 ***	0.408 ***	0.798 ***	0.529 ***	0.567 ***
	(0.028)	(0.029)	(0.055)	(0.035)	(0.046)
GDP per capita	-0.222 ***	0.133 ***	0.282 ***	0.367 ***	0.064 ***
	(0.065)	(0.033)	(0.026)	(0.052)	(0.019)
Credit (%GDP)	-0.855 ***	0.056	-0.210 ***	-0.715 ***	-0.200 ***
	(0.082)	(0.064)	(0.057)	(0.096)	(0.044)
Trade (%GDP)	0.002 *	0.249 ***	0.185 ***	-0.235 ***	0.470 ***
	(0.001)	(0.051)	(0.028)	(0.063)	(0.036)
Constant	5.479 ***	-2.513 ***	-2.354 ***	0.870 **	-1.805 ***
	(0.709)	(0.257)	(0.389)	(0.367)	(0.221)
Countries	62	62	62	62	62
Instruments	15	17	17	15	15
Linearity test (p)	0.000	0.000	0.000	0.000	0.000

Notes: Gov_vul: vulnerability of the overall governance indicator constructed through the principal component analysis of CC_vul: vulnerability of the control of corruption indicator, RQ_vul: vulnerability of the regulatory quality indicator, RLaw_vul: vulnerability of the rule of law indicator. Stars indicate statistical significance at the 10%, 5% and 1% levels. Robust standard errors are in parentheses

positive in the first regime and negative in the second regime. The estimated threshold value of oil rents-to-GDP is 53.4%, and the linearity test indicates an overall significant non-linear relationship. This threshold value is relatively smaller than the one found in column 1 of Table 5. This could suggest that the PSTR overestimates the threshold of oil rents-to-GDP.

In columns (2)–(5) the threshold variable is institutional vulnerability, and the regime-dependent variable is the oil rents-to-GDP ratio. Column 2 displays the results from the overall governance indicator. The coefficient of oil rents-to-GDP is positive and significant in the first regime, while it is negative in the second regime of governance vulnerability. The estimated threshold value is 0.802. Once more, the non-linearity between the two regimes is confirmed with the p-value of the linearity test.

Using alternative indicators of institutional quality, we obtain similar results. Specifically, control of corruption, regulatory quality, and rule of law vulnerability exhibit a threshold value of 0.761, 0.373 and 0.446, respectively. One possible explanation for the high estimated threshold value for control of corruption is that controlling corruption is relatively more difficult and time-consuming because corruption is an informal phenomenon.

5. Discussion and conclusion

This article contributes to the research on entrepreneurship development in resource-dependent countries. More precisely, we investigated the nonlinear relationship between oil rent dependence and new business density. We used the panel smooth transition regression (PSTR) model of Gonzalez et al. (2005) with additional robustness checks through the dynamic panel threshold regression model proposed by Seo and Shin (2016). The results reveal two main pieces of evidence. First, there is an inverted U-shaped relationship between oil rents and entrepreneurship. As oil rents to GDP increase, entrepreneurship first increases, peaks, and then begins to decrease. That is, oil rents harm entrepreneurship only when the value of oil rents-to-GDP is large enough. For a wider investigation, we split our sample into developing countries, middle-income countries, and between African, American, Asian, and European and Pacific regions, respectively. In 5 of these 6 subsamples, the results remain identical to those of the global sample. However, in the Asian region, where a majority of Middle-Eastern countries are included, oil rents reduce entrepreneurship just above the threshold. This finding is justified by the fact that Middle-Eastern countries are mostly oil-dependent countries, as reflected in their low economic diversification (UNCTAD, 2019; Matallah, 2020).

The second result is that institutional vulnerability may make oil rents less effective in entrepreneurship. In other words, the contribution of oil rents is smaller in countries with high institutional vulnerability. This finding suggests that oil rents will not be effective in entrepreneurship and economic development until control of corruption, regulatory quality and the enforcement of property rights are strong enough. Indeed, natural resources move productive activities into rent-seeking ones, thereby lowering the national income and welfare under vulnerable institutions (Torvik, 2002). Furthermore, increasing resource rents increase the value of holding power, and incentivize politicians to misallocate them (Caselli and Cunningham, 2009; Omgba, 2009). Governments use resource revenues to monopolise power by promoting access and rewarding political supporters through increased public employment (Robinson et al., 2006). These spending practices may deplete foreign exchange, increase debt burdens and crowd out investments in more productive sectors (Harris et al., 2020), thus lowering entrepreneurship considerably (Farzanegan, 2014).

The results of this study have important policy implications for resource-rich countries. The non-linear relationship between natural resources and entrepreneurship backed by the inverted U-shape converges both with the theoretical and empirical literature. Hence, natural resource rents are not a curse per se, but the way in which they are managed determines the extent of their curse. Governments in resource-rich countries, especially those with oil resources, should therefore implement policies to strengthen property rights, reduce corruption and better regulate productive activity. This would have positive implications on both the demand and supply sides for entrepreneurship and economic development.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ecosys.2022.101059.

References

Acemoglu, D., 1995. Reward structures and the allocation of talent. Eur. Econ. Rev. 39 (1), 17–33.
Acemoglu, Daron, Simon Johnson, and James A.. Robinson. 2003. "An African Success Story: Botswana." In In Search of Prosperity: Analytic Narratives on Economic Growth, ed. Dani Rodrik, 80–119. Prince ton and Oxford: Princeton University Press.
Adams, D., Adams, K., Ullah, S., Ullah, F., 2019. Globalisation, governance, accountability and the natural resource 'curse': Implications for socio-economic growth of oil-rich developing countries. Resour. Policy 61, 128–140.
Alexeev, M., Conrad, R., 2011. The natural resource curse and economic transition. Econ. Syst. 35 (4), 445–461.
Ali, S., Murshed, S.M., Papyrakis, E., 2020. Happiness and the resource curse. J. Happiness Stud. 21 (2), 437–464.
Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. Rev. Econ. Stud. 58 (2), 277–297.
Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. J. Econ. 68 (1), 29–51.
Asongu, S., Nwachukwu, J., 2018. Openness, ict and entrepreneurship in sub-saharan africa. Inf. Technol. People 31 (1), 278–303.
Atangana Ondoa, H, 2019. Natural resources curse: a reality in Africa. Resour. Policy 63 (C), 101406.
Auty, R.M., 1994. Industrial policy reform in six large newly industrializing countries: the resource curse thesis. World Dev. 22 (1), 11–26.
Awoa Awoa, P., Atangana Ondoa, H., Ngoa Tabi, H., 2022. Women's political empowerment and natural resource curse in developing countries. Resour. Policy 75 (C), 102442.
Badeeb, R.A., Lean, H.H., Clark, J., 2017. The evolution of the natural resource curse thesis: a critical literature survey. Resour. Policy 51, 123–134.
Baland, J.-M., Francois, P., 2000. Rent-seeking and resource booms. J. Dev. Econ. 61 (2), 527–542.
Baumol, W.J., 1968. Entrepreneurship in economic theory. Am. Econ. Rev. 64–71.
Baumol, W.J., 1990. Entrepreneurship: productive, unproductive, and destructive. J. Polit. Econ. 98, 893–921.
Beck, T., Demirguc-Kunt, A., 2006. Small and medium-size enterprises: access to finance as a growth constraint. J. Bank. Financ. 30 (11), 2931–2943.
Ben-Salha, O., Dachraoui, H., Sebri, M., 2021. Natural resource rents and economic growth in the top resource-abundant countries: a PMG estimation. Resour. Policy(*74*).
Béreau, S., Villavicencio, A.L., Mignon, V., 2010. Nonlinear adjustment of the real exchange rate towards its equilibrium value: a panel smooth transition error correction modelling. Econ. Model. 27 (1), 404–416.
Bhattacharyya, S., Hodler, R., 2014. Do natural resource revenues hinder financial development? the role of political institutions. World Dev. 57, 101–113.
Bjørnskov, C., Foss, N.J., 2008. Economic freedom and entrepreneurial activity: Some cross-country evidence. Public Choice 134 (3), 307–328.
Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. J. Econ. 87 (1), 115–143.
Bonet-Morón, J., Pérez-Valbuena, G.J., Marín-Llanes, L., 2020. Oil shocks and subnational public investment: The role of institutions in regional resource curse. Energy Econ. 92.
Boschini, A.D., Pettersson, J., Roine, J., 2007. Resource curse or not: a question of appropriability. Scand. J. Econ. 109 (3), 593–617.
Brunnschweiler, C.N., Bulte, E.H., 2008. The resource curse revisited and revised: a tale of paradoxes and red herrings. J. Environ. Econ. Manag. 55 (3), 248–264.
Caner, M., Hansen, B.E., 2004. Instrumental variable estimation of a threshold model. Econom. Theory 20 (5), 813–843.
Canh, N.P., Nguyen, B., Thanh, S.D., Kim, S., 2021. Entrepreneurship and natural resource rents: Evidence from excessive entrepreneurial activity. Sustain. Prod. Consum. 25, 15–26.
Canh, N.P., Schinckus, C., Thanh, S.D., 2020. The natural resources rents: Is economic complexity a solution for resource curse? Resour. Policy 69.
Caselli, F., Cunningham, T., 2009. Leader behaviour and the natural resource curse. Oxf. Econ. Pap. 61 (4), 628–650.
Chambers, D., Munemo, J., 2019a. Natural resource dependency and entrepreneurship: Are nations with high resource rents cursed? J. Int. Dev. 31 (2), 137–164.
Chambers, D., Munemo, J., 2019b. Regulations, institutional quality and entrepreneurship. J. Regul. Econ. 55 (1), 46–66.
Dauvin, M., Guerreiro, D., 2017. The paradox of plenty: A meta-analysis. World Dev. 94, 212–231.
Djankov, S., Ganser, T., McLiesh, C., Ramalho, R., Shleifer, A., 2010. The effect of corporate taxes on investment and entrepreneurship. Am. Econ. J.: Macroecon. 2 (3), 31–64.
Djimeu, E.W., Omgba, L.D., 2019. Oil windfalls and export diversification in oil-producing countries: Evidence from oil booms. Energy Econ. 78, 494–507.
Ebeke, C., Omgba, L.D., Laajaj, R., 2015. Oil, governance and the (mis) allocation of talent in developing countries. J. Dev. Econ. 114, 126–141.
Farhadi, M., Islam, M.R., Moslehi, S., 2015. Economic freedom and productivity growth in resource-rich economies. World Dev. 72, 109–126.
Farzanegan, M.R., 2014. Can oil-rich countries encourage entrepreneurship? Entrep. Reg. Dev. 26 (9–10), 706–725.
Fouquau, J., 2008. Threshold effects in Okun's law: a panel data analysis. Econ. Bull. 5.
Gonzalez, A., Terasvirta, T., and van DIJK, D.. (2005). Panel smooth transition regression model. In Working paper series in economics and finance, no. 604, Stockholm.
Granger, C., Teräsvirta, T., 1993. Modelling non-linear economic relationships. Technical report. Oxford University Press,.
Gries, T., Naudé, W., 2010. Entrepreneurship and structural economic transformation. Small Bus. Econ. 34 (1), 13–29.
Grossman, G.M., Helpman, E., 1991. Trade, knowledge spillovers, and growth. Eur. Econ. Rev. 35 (2–3), 517–526.
Hansen, B.E., 1999. Threshold effects in non-dynamic panels: Estimation, testing, and inference. J. Econ. 93 (2), 345–368.
Harris, A.S., Sigman, R., Meyer-Sahling, J.-H., Mikkelsen, K.S., Schuster, C., 2020. Oiling the bureaucracy? political spending, bureaucrats and the resource curse. World Dev. 127.
Harris, J.D., Sapienza, H.J., Bowie, N.E., 2009. Ethics and entrepreneurship. J. Bus. Ventur. 24 (5), 407–418.
Hartwell, C.A., 2016. The institutional basis of efficiency in resource-rich countries. Econ. Syst. 40 (4), 519–538.
Kamguia, B., Keneck-Massil, J., Nvuh-Njoya, Y., Tadadjeu, S., 2022. Natural resources and innovation: Is the R&D sector cursed too? Resour. Policy *77*.
Kremer, S., Bick, A., Nautz, D., 2013. Inflation and growth: new evidence from a dynamic panel threshold analysis. Empir. Econ. 44 (2), 861–878.
Kuznets, S., 1955. Economic growth and income inequality. Am. Econ. Rev. 45 (1), 1–28.
Lane, P.R., Tornell, A., 1996. Power, growth, and the voracity effect. J. Econ. Growth 1 (2), 213–241.
Leff, N.H., 1979. Entrepreneurship and economic development: the problem revisited. J. Econ. Lit. 17 (1), 46–64.
Majbouri, M., 2016. Oil and entrepreneurship. Energy Policy 94, 10–15.
Matallah, S., 2020. Economic diversification in mena oil exporters: Understanding the role of governance. Resour. Policy 66.
Menaldo, V., 2016. The Institutions Curse. Cambridge University Press, Cambridge.

Munemo, J., 2021. Do african resource rents promote rent-seeking at the expense of entrepreneurship? Small Bus. Econ. 1–14.
Murphy, K.M., Shleifer, A., Vishny, R.W., 1993. Why is rent-seeking so costly to growth? Am. Econ. Rev. 83 (2), 409–414.
Okkonen, L., Suhonen, N., 2010. Business models of heat entrepreneurship in Finland. Energy Policy 38 (7), 3443–3452.
Omgba, L.D., 2009. On the duration of political power in africa: the role of oil rents. Comp. Political Stud. 42 (3), 416–436.
Rauch, J., 1996. Trade and search: social capital. Sogo Shosha, and Spillovers. National Bureau of Economic Research, Inc.
Rauch, J.E., 1999. Networks versus markets in international trade. J. Int. Econ. 48 (1), 7–35.
Robinson, J.A., Torvik, R., Verdier, T., 2006. Political foundations of the resource curse. J. Dev. Econ. 79 (2), 447–468.
Sachs, J.D. and Warner, A.M. (1995). Natural resource abundance and economic growth. NBER Working Paper.
Sala-i-Martin, X., Subramanian, A., 2008. Addressing the natural resource curse: an illustration from Nigeria. *Economic policy Options for a Prosperous Nigeria*. Palgrave Macmillan, London, pp. 61–92.
Seo, M.H., Shin, Y., 2016. Dynamic panels with threshold effect and endogeneity. J. Econ. 195 (2), 169–186.
Seo, M.H., Kim, S., Kim, Y.-J., 2019. Estimation of dynamic panel threshold model using stata. Stata J. 19 (3), 685–697.
Shahbaz, M., Destek, M.A., Okumus, I., Sinha, A., 2019. An empirical note on comparison between resource abundance and resource dependence in resource abundant countries. Resour. Policy 60, 47–55.
Stijns, J.-P., 2006. Natural resource abundance and human capital accumulation. World Dev. 34 (6), 1060–1083.
Sun, Y., Ak, A., Serener, B., Xiong, D., 2020. Natural resource abundance and financial development: A case study of emerging seven (e- 7) economies. Resour. Policy 67.
Tornell, A., Lane, P.R., 1999. The voracity effect. Am. Econ. Rev. 89 (1), 22–46.
Torvik, R., 2002. Natural resources, rent seeking and welfare. J. Dev. Econ. 67 (2), 455–470.
UNCTAD. (2019). State of commodity dependence 2019. United Nations Conference on Trade and Development.
Wen, J., Yang, D., Feng, G.-F., Dong, M., Chang, C.-P., 2018. Venture capital and innovation in china: The non-linear evidence. Struct. Change Econ. Dyn. 46, 148–162.
World Bank. (2021a). Doing Business: entrepreneurship database. http://www.doingbusiness.org/data/exploretopics/entrepreneurship. The World Bank.
World Bank. (2021b). World development indicators 2020. The World Bank.