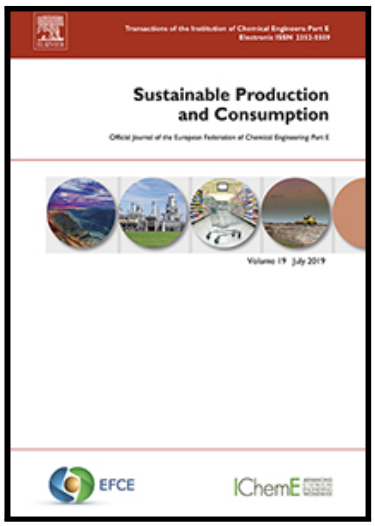

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ENTREPRENEURSHIP AND NATURAL RESOURCE RENTS: EVIDENCE FROM EXCESSIVE ENTREPRENEURIAL ACTIVITY

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Abstract: This study investigates the impact of excessive entrepreneurial activity on natural resource rents. We employ the ecological perspective to argue that while

entrepreneurship is usually associated with innovation and improved efficiency, and thus reduced natural resource rents, excessive entrepreneurial activity may increase natural resource rents and harm the environment. Investigating a global sample of 70 countries over 11 years (2006–2016) using advanced techniques to address econometric issues, we find initial evidence supporting the natural resource rents of excessive entrepreneurship. We also find heterogeneity between high-income economies (HIEs) and low and middle-income economies (LMEs) as well as between four vital natural resources: coal, gas, forest, and minerals. The findings in this study contribute to the growing literature examining sustainable entrepreneurial ecosystems.

Keywords: Entrepreneurship; excessive start-up; natural resources rents; environment.

JEL code: L26, M13, O13, Q23, N50.

1. Introduction

Entrepreneurship is essential for economic growth (Baumol, 1968, Schumpeter, 1965). This well-established statement, which originated from neo-classical economic theory, implies that more entrepreneurial activity is always better for any economy (Nguyen, 2019, Nguyen et al.). Also, entrepreneurial activity is often found to have strong links with innovation (Fuentelsaz et al., 2018), which plays an important role in securing the long-term survival of the economy by constraining overconsumption and mitigating climate change. However, too much entrepreneurial activity may not be positive, particularly when the number of entrepreneurs exceeds a certain optimal level; Prieger et al. (2016) propose the existence of an optimal level of entrepreneurship in each economy. Entrepreneurial activity, if it exceeds the optimal level, may negatively influence economic growth.

Meanwhile, in another strand of study, the link between economic growth and natural resources has been examined mainly under the "resource curse" hypothesis, which states that nations endowed with abundant natural resources are usually cursed with stagnant economic development (e.g., Africa) (Canh and Thong, 2020). Ben-Salha et al. (2019) provide a model with four explanations for this paradox: (1) the long-term fall of primary product prices; (2) the volatility of commodities price; (3) "Dutch disease"; and (4) institutional weaknesses. This framework helps us understand why excessive natural resources (resource boom) may not always be beneficial to economic growth.

In this respect, recent studies regard opportunistic entrepreneurs (in contrast to social entrepreneurs and sustainable entrepreneurs) as agents that determine the rent-seeking of natural resources (Canh et al., 2020). For example, Torvik (2002) shows that natural resources move productive entrepreneurs into rent-seeking activity, lowering national income and welfare. Murphy et al. (1993), Robinson (1994), and Acemoglu (1995) suggest that initial rent-seeking activity reinforces itself by crowding out productive entrepreneurship from the market. An increase in the number of rent-seekers lowers the returns from both rent-seeking and productive entrepreneurship; however, the effect is greater on the returns from productive entrepreneurship. Baland and Francois (2000)

argue that an increase in natural resources enhances domestic rent-seeking when the initial proportion of agents engaged in rent-seeking is large.

Building on these two strands of literature, our study investigates whether excessive entrepreneurial activity above the optimal level has a negative impact on natural resource rents. The study provides a mechanism through which economic growth from the ecological perspective may be harmed by the presence of too many opportunistic entrepreneurs. The study underscores the point that ecological constraints are a significant problem for economic growth, leading to the need to reconsider the long-held view that the more entrepreneurial activity, the better (Barbier, 2005, Potts et al., 2010).

Specifically, we propose a positive relationship between excessive entrepreneurship and natural resource rents. We acknowledge that entrepreneurship is typically associated with innovation and improved efficiency, and thus contributes to economic growth (Audretsch and Keilbach, 2004). When there are too many small entrepreneurs; however, technological progress stemming from large-scale R&D and scale economies may suffer; this lowers economic efficiency (Prieger et al., 2016). Severe competition requires economic agents, both newcomers and incumbent firms, to secure every opportunity for survival and growth; this makes entrepreneurs more opportunistic, and they pursue higher natural resource rents as a result.

We test our rent-seeking hypothesis by using a global sample of 70 countries for the period 2006-2016. Our empirical settings allow us to control for all relevant econometric issues and so generate consistent and reliable results. We conduct a set of supplemental analyses on two groups of economies: low and middle-income economies (LMEs) and high-income economies (HIEs). We also analyze four natural resources: coal, gas, forest, and minerals.

Empirically, we find a positive association between excessive entrepreneurial activity and natural resource rents. We also find that the natural rent-seeking of excessive entrepreneurship is stronger in HIEs than in LMEs and that the effects are greater on mineral rents and forest rents than on coal rents and gas rents. Thus, we propose that there

is an optimal level of entrepreneurship that balances economic growth and environmental protection.

Our study contributes to the relevant literature in three principal ways. First, it is one of the first studies to investigate the relationship between excessive entrepreneurship and natural resource rents systematically. We combine the entrepreneurship literature with the literature on ecological economics to explain the natural rent-seeking of excessive entrepreneurship. Our study subscribes to Prieger et al. (2016)'s proposition that entrepreneurial activity above the optimal level reduces economic growth.

Second, findings in this study extend the emerging strand of research highlighting the importance of sustainable entrepreneurial ecosystems. Following Ludeke-Freund (2020), we suggest that economic growth should not be seen as the sole ultimate goal of entrepreneurship. A sustainable entrepreneurial ecosystem may lead to slower growth rates or even de-growth. However, the social and environmental benefits obtained from such an ecosystem may be worth pursuing (van Lunenburg et al., 2020).

Third, we carefully examine the heterogeneity associated with HIEs and LMEs, as well as the four types of natural resources. Thus, our findings provide a broad perspective on the impact of excessive entrepreneurship on natural resource rents. Finally, our study puts forward useful suggestions for policymakers who seek to find a balance between boosting entrepreneurship and protecting the environment.

We organize this study as follows. In section 2, we provide the literature review. In section 3, we present the data and the empirical model. In section 4, we first estimate a proxy of excessive entrepreneurship and use the proxy to estimate its impact on natural resource rents. We then discuss the empirical results. In section 5, we conclude the study.

2. Literature Review

The relationship between natural resources and entrepreneurial activity is a controversial topic in the extant literature. Previous studies mainly focus on testing the resource curse hypothesis, which mainly revolves around the question "are nations with high resource rents cursed with reduced entrepreneurial activity?" The empirical findings

against this hypothesis are, unfortunately, mixed and inclusive. For example, Chambers and Munemo (2019) test the hypothesis on 116 countries in the period 2001–2012 and show that nations with substantial natural resource extraction exhibit limited entrepreneurial activity. On the other hand, Ben-Salha et al. (2019), using a sample of top resource-abundant countries in the period 1970–2013, find evidence that the natural resource blessing hypothesis is valid in the long run.

In an endeavour to synthesize the literature, Baland and Francois (2000) propose a theoretical model which states that the influence of natural resources on entrepreneurial activity depends critically on the nature of the equilibrium that existed in the country when resources started to increase. When the initial proportion of agents engaged in entrepreneurship (innovative activities) is large, an increase in the economy's resources increases domestic entrepreneurship. However, when a large proportion of individuals are already engaged in rent-seeking, a resources boom inclines the economy toward more rent-seeking.

Based on previous studies, we argue that resource rent-seeking may increase when there is an excessive number of entrepreneurs in an economy. In other words, when entrepreneurial activity is held at an appropriate level, entrepreneurs will contribute to economic growth by introducing innovations and improving economic efficiency. However, when entrepreneurial activity exceeds the equilibrium level, the forces of competition (among new firms and between new firms and incumbent firms) may outweigh the innovation effect and incentivize entrepreneurs to seek rents from natural resources to gain competitive advantage.

Before establishing the theoretical mechanisms underpinning the expected non-linear relationship between resource rent and entrepreneurship, we first define natural resources and distinguish natural resource rent from Schumpeterian rent, which are the key concepts of our theoretical framework.

Natural resources are defined by the World Trade Report as "stocks of materials that exist in the natural environment that are both scare and economically useful in the production or consumption, either in their raw state or after a minimal amount of

processing" (Report, 2010). The notion of rent was developed by Tullok to indicate that an entity seeks to gain added wealth without any reciprocal contribution of productivity (Tullock, 1967).[i] In this study, we use the term natural resource rent or resource rent to indicate the abuse of natural resources by entrepreneurs seeking private gain (e.g., profits, business survival, or growth) without adequately contributing to the economy by introducing innovations and improving efficiency.

In contrast, Schumpeterian rent, defined as "the additional value that results from a new combination of resources (including new modes of organization) that an entrepreneur may have undertaken" (Sautet, 2013). Schumpeterian rent can be seen as abnormal profits that entrepreneurs earn from their venture activities and is the driving force behind the process of creative destruction (Danneels, 2012). Nonetheless, Schumpeterian rent is transient by nature, in the sense that it arises only in situations of disequilibrium when the economy shifts from the old modes to new modes. Once the market settles into a new equilibrium, these rents disappear (Sautet, 2013).

Entrepreneurs who aim to acquire Schumpeterian rent will try to push the economy out of its current equilibrium by introducing new products to replace older ones. This process of creative destruction is usually associated with innovation, new business models, and improved efficiency, which lead to reduced natural resource rent (Stephan et al., 2015). However, it is noteworthy that, according to ecological economics, production and consumption are fundamentally a linear function of raw material (Chambers and Munemo, 2019, Barbier, 2005)[1] As such, economic activities will ultimately induce amplified resource rents, i.e., an increase in the contributions (in the absolute values) of coal, mineral, gas, and forest in GDP (Behrens et al., 2007). This amplified resource rent effect may outweigh the creative destruction effect, especially when there is an excessive number of entrepreneurs in an economy, for the following reasons.

First, facing severe competition, entrepreneurs may become more opportunistic and driven by rent-seeking to secure survival and growth opportunities for their business ventures (Prieger et al., 2016). Baumol (2004) emphasizes that entrepreneurship should

[1] Along with other neoclassical factors, such as labour and capital.

not be equated to virtuous behaviour: "because we recognize that entrepreneurship can bring innovation and growth, we are misled into thinking that it must always contribute to economic abundance and expansion." In fact, the ultimate goal of entrepreneurs is the acquisition and accumulation of wealth, power, and prestige, with innovation used as a primary weapon (Lafuente et al., 2018).

When there are excessive numbers of entrepreneurs, severe competition may significantly increase the marginal costs of capital and labour, leading to reduced profit margins (Prieger et al., 2016, Lafuente et al., 2018). Entrepreneurs are thus incentivized to extract more natural resources (either directly or indirectly), whose marginal cost may increase at a slower pace compared to capital and labour. An example of indirect natural resource-seeking behaviour is that in highly competitive environments, entrepreneurs may seek lower-priced inputs and materials. In response to this pressure, their suppliers may adopt natural rent-seeking strategies to meet the requirements of their clients. The reason for the relatively low marginal cost of natural resources is primarily due to government policies aimed at keeping resources accessible to domestic producers at affordable prices to secure nations' economic health and boost economic development (Haas, 2011).

In such circumstances, entrepreneurs may come up with business models that rely less on high-skilled human capital (the cost of hiring employees increases in severe competition) or on low value-added technology (the cost of funding R&D investments increases in severe competition), and employ lower-priced, easy-accessed natural resources to make profits (Cressy, 1992, Chell, 2000). Thus, seeking rent from natural resources could be regarded as a feasible strategy under situations of acute competition.

The second reason is that excessive entrepreneurship not only affects newcomers but also influences the behaviour of incumbent firms (Bretschger, 2005). With severe competition and a large number of newly-established firms whose operations are more flexible and efficient, incumbent firms may become more opportunistic in resource rent-seeking behaviour to secure their market positions (Buenstorf, 2016). Specifically, Prieger et al. (2016) investigating a global sample show that when there are too many small businesses, competition in the economy will suffer, with an attendant loss of efficiency in

the sense that technological progress stemming from large-scale R&D will become stagnant. Since R&D takes time and is associated with substantial opportunity costs, incumbent firms may decide to direct their investments toward short-term, low-cost but resource-consuming technology as a "quick and easy" competition strategy (Wennekers and Thurik, 1999). Thus, following Torvik (2002), we argue that the effects of excessive competition may outweigh the direct positive effects of improved efficiency and innovation.

Third, entrepreneurship is a (novel) production process that needs natural inputs. Excessive entrepreneurial activity will, therefore, lead to the increased usage of natural resources in the economy. Potts et al. (2010) hold an optimistic viewpoint that increasing environmental damage or the onset of an impending ecological collapse may present entrepreneurial opportunities. We, however, argue that negative externalities (e.g., resource rents) cannot be removed entirely by entrepreneurial actions, especially in situations of severe competition (Schumpeter, 1965, Torvik, 2002). The reason is that entrepreneurs, at the individual level, have no incentive to consider the "big picture" of the natural resource extraction in the economy; their ultimate objective is to maximize Schumpeterian rents and leave the issue of negative externalities to their government (McMullen et al., 2008). Also, Estapé-Dubreuil et al. (2016) find that firms focusing too closely on environmental issues (at the same time as social issues) are significantly inferior in attracting financial investors. Thus, entrepreneurs facing fierce competition have a strong motivation to seek natural resource rents. This undesirable behaviour may overshadow their contribution to the economy.

In sum, we expect entrepreneurial activity to exert a non-linear (U-shaped) effect on a nation's natural resource rents. Specifically, there is an optimal level of entrepreneurship in an economy; entrepreneurial activity exceeding this threshold may incentivize economic agents (both new and incumbent) to seek rents from natural resources to secure the survival and growth of their business.

3. Data and Empirical Model

Empirical Model

Since the aim of this study is to examine the effects of excessive entrepreneurship on natural resources rents, we adopt a baseline empirical model of natural resource rents as follows:

$$NRR_{it} = \alpha_0 + \beta_1 Y_{it} + \beta_1 Y_{it}^2 + \beta_2 Inv_{it} + \beta_3 Urb_{it} + \beta_4 Trade_{it} + \beta_5 FDI_{it} + \varepsilon_{it}, \quad [1]$$

where NR, Y, $Inv, Urb, Trade$ and FDI represent natural resource rents, national income, new investments, urbanization and foreign direct investment, respectively.

The baseline model includes economic development (Y) and its vitality (Inv) to account for natural resource rents because economic development is one of the main drivers and economic activities consume natural resources (e.g., Abdulahi et al. (2019)). In terms of social factors, urbanization represents a change in living standards and social structure. Urbanization requires heavy use of natural resources, such as cement, steel, aluminium, and coal, thereby increasing natural resource rents (Shen et al., 2005). Urbanization is usually associated with industrialization processes, which lead to a higher demand for natural resources (Mudakkar et al., 2013). Meanwhile, trade openness and FDI inflows are a proxy for economic integration (Hajzler, 2014, Ndikumana and Sarr, 2019, Phuc Nguyen et al., 2019), which may exert either a negative or positive impact on natural resource rents through the pollution haven or pollution halo hypotheses (Phuc Nguyen et al., 2019). Finally, the square term of the income level is added into the model to control for the environmental Kuznets curve (EKC) hypothesis, which proposes a non-linear relationship between economic development and environmental degradation.

To investigate the influence of excessive entrepreneurial activity on natural resources rents, we add a set of dummy variables (DUM) representing excessive entrepreneurship to the baseline model. The empirical model is as follows:

$$NRR_{it} = \alpha_0 + \alpha_1 DUM_{it} + \beta_1 Y_{it} + \beta_1 Y_{it}^2 + \beta_2 Inv_{it} + \beta_3 Urb_{it} + \beta_4 Open_{it} + \beta_5 FDI_{it} + \varepsilon_{it}$$ [2]

Data

We collect the new business density (new registrations per 1,000 people ages 15-64) from World Development Indicators (WDIs – World Bank) and take logarithms as a proxy for entrepreneurial activity. This entrepreneurship rate is employed in the next paragraph to estimate the level of excessive entrepreneurship, which is the level of entrepreneurial activity that exceeds the optimal level of entrepreneurship in an economy. We should, in principle, identify the optimal level of entrepreneurship for every economy. Although there is no consensus in the literature on what is the optimal level of entrepreneurship, Prieger et al. (2016) completed one of the most critical studies on this topic, proposing that a country will suffer a "growth penalty" when entrepreneurship deviates from its optimal level. Prieger et al. (2016) put forward the following equation:

$$y_{it} = y^*_{it} - \partial \left| logTEA_{it-1} - logTEA^*_{it} \right| + (\alpha_i + \varepsilon_{it}),$$ [3]

in which *i* and *t* denote country *i* in year *t*, respectively; *y* is national output and *y** is national output at optimal entrepreneurship; *TEA* is total entrepreneurship rate and *TEA** is the optimal level of entrepreneurship rate; α is a country-specific term, and ε is the residual term. From the equation, we can extrapolate the optimal level of entrepreneurship as follows:

$$logTEA^*_{it} = \beta_1 logTEA_{it-1} + \beta_2 \left(y_{it} - y^*_{it} \right) + (\alpha_i + \varepsilon_{it}),$$ [4]

in which $(y_{it} - y^*_{it})$ represents the output gap in the economic literature (Orphanides and Norden, 2002). To limit the feedback effect from entrepreneurship on economic growth (Galindo and Méndez, 2014), which would lead to the problem of endogeneity, the study further transforms Eq. [4] by using a one-year lag of output gap in empirical estimation:

$$logTEA^*_{it} = \beta_1 logTEA_{it-1} + \beta_2 \left(y_{it-1} - y^*_{it-1} \right) + (\alpha_i + \varepsilon_{it})$$ [5]

At this stage, we face a new issue, i.e., the estimation of the output gap, which is one of the most debated topics in the economic literature (Orphanides and Norden, 2002). Therefore, we apply several strategies to estimate output gaps as a way of reducing concerns related to technical biases.

First, we use a traditional way of estimating the log of real GDP for year (time factor) to extract real GDP variable from cyclicality and trend factors (Clark, 1987). In the estimation, the trend series represent long-term development while the cyclicality represents the short-term fluctuation surrounding the long-term trend. That is, the cyclicality (or the residual from this estimation) is divided by its trend to get a standardized percentage, which forms the output gap. This measure of the output gap is then included in Eq. (3) to estimate excessive entrepreneurship. This method is, however, a naïve technique since it only concerns a time-trend over the long-term. So, the study applies a second technique to estimate the output gap by recruiting the Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1997) to estimate the cyclical factor of real GDP and then includes the result into Eq. [3] as the output gap as well. There are criticisms of the HP filter (e.g., see Hamilton (2018)), and so we use it as one of several ways to estimate the output gap and the excessive entrepreneurship activity as a robustness check. Also, we estimate real GDP growth rate with one-year lag and then extract the residual term to divide by the fitted value from the estimations as the third proxy of the output gap.

After the estimation of Eq. [5] with three different proxies of the output gap and the residual terms predicted, we create a set of dummy variables (DUM1, DUM2, DUM3) which represents the existence of excessive entrepreneurship by the rule that if the residual term is positive, the dummy value is 1, suggesting the existence of excessive entrepreneurship; otherwise, the value is 0. The logic here is that the fitted value from Eq. [5] is the assumed optimal level of entrepreneurship. As such, if the residual is greater than zero, the actual value of the entrepreneurship rate is higher than the optimal level, indicating the existence of excessive entrepreneurship.

The above methods drawing on Prieger et al. (2016) do not consider other socio-economic determinants of entrepreneurship (Ramos-Rodríguez et al., 2012, Sasu and Sasu,

2015, Thai and Turkina, 2014). Thus, the methods might be weak in capturing all the information about entrepreneurial activity. Therefore, in this study, we go further to incorporate a comprehensive list of covariates and estimate the optimal level of entrepreneurship using a stepwise strategy.

We first estimate the entrepreneurship rate with a one-year lag and assume that any variation from its long-term trend is a cyclical factor of entrepreneurship. Then, we estimate the entrepreneurship rate using its one-year lag, as well as the income level (log of real GDP per capita). Previous studies (Dvouletý, 2018, Ramos-Rodríguez et al., 2012, Thai and Turkina, 2014) have concluded that the trend in entrepreneurship is a function of income level, which represents economic development. Our model also includes covariates such as economic growth, unemployment rate, human capital, institutional quality, and economic freedom. These factors are well documented in the extant literature as critical drivers of entrepreneurial activity (Fuentelsaz et al., 2019, Chowdhury et al., 2019, Chambers and Munemo, 2019). Applying the same procedure, we extract the residuals from each estimation and divide by their fitted value obtained from the estimations. The dummy variables (DUM4, DUM5, DUM6) are created following the principle that if the residuals are greater than zero, the value is 1, suggesting the existence of excessive entrepreneurship; otherwise, the value is 0.

[insert Table 1 here]

Table 1 presents estimates of excessive entrepreneurship. In Model (1), we divide the residual term from Model (1) by real GDP to calculate the output gap in percentage form. In Model (2), we use the output gap from Model (1) as a regressor and predict the residual term from Model (2) to measure the dummy variable (*DUM1*) of excessive entrepreneurship. *DUM1* equals 1 if the residual from Model (2) is greater than 0; otherwise, DUM1 equals 0.[2]

[2] The correlation between the log of entrepreneurship density (-1) and output gap (-1) is 0.08, and the (variance inflation factor) VIF test shows no evidence of multicollinearity (VIF<10) between the two independent variables in Model (2).

In Model (3), we measure the cyclical factor of real GDP by the cyclical factor from the HP filter for the log of real GDP. We use the residual of Model (3) to measure the dummy variable (*DUM2*) of excessive entrepreneurship, which equals 1 if the residual from Model (3) is greater than 0. In Model (4), we regress the real GDP growth rate with a one-year lag and plug its residual into Model (5). In Model (5), we regress the log of entrepreneurship density with a one-year lag and the residual from Model (4). Likewise, we use the residual of Model (5) to measure the dummy variable (*DUM3*) of excessive entrepreneurship.

In Model (6), we regress the log of entrepreneurship density with a one-year lag. We use the residual of Model (6) to measure the dummy variable (*DUM4*) of excessive entrepreneurship, which equals 1 if the residual is larger 0; otherwise, it equals 0. In Model (7), we regress the log of entrepreneurship density with a one-year lag and the log of real GDP per capita (one-year lag). Then, we use the residual of Model (7) to estimate the dummy variable (*DUM5*) of excessive entrepreneurship in the same way. In Model (8), we regress the log of entrepreneurship density with a one-year lag, the log of real GDP per capita (one-year lag), unemployment rate (one-year lag), one-year lag of log of the human capital index (from PWT), one-year lag of the average of six institutional indicators from worldwide governance indicators (World Bank), and one-year lag of the economic freedom index. We use the residual of Model (8) to measure the dummy variable (*DUM6*) of excessive entrepreneurship.

Of the variables used, real GDP per capita and economic growth rate are collected from WDIs, the human capital index is collected from Penn World Tables 9.1 (PWT), six institutional indicators are collected from (World Bank), and the economic freedom index is collected from the Heritage Foundation. The percentage of total natural resource rents to GDP (*NRR*) is collected from WDIs. According to the World Bank, the NRR is measured by the difference between the value of production at world prices and total cost of production. That is, the value of natural resources in GDP can represent the increase in prices of natural resource rents and also the higher abuse of natural resources. Even with the increases in prices or abuse of natural resources, any increase in natural resource values in GDP would reflect the higher dependence of the economy on natural resources and can imply a higher

level of exploitation of natural resources. Gross capital formation (% of GDP), urban population to total population (%), total trade value (% of GDP), foreign direct investment net inflows (% of GDP) are collected from WDIs to proxy for income level (*Income*), population density (*Popden*), capital formation (*Cap*), urbanization (*Urban*), trade openness (*Trade*), and FDI inflows (*FDI*) respectively.

There are missing data in entrepreneurship density, coal rents, mineral rents, and natural gas rents in several countries including some countries with high natural resources rents such as Gulf Cooperation Council countries. Furthermore, some countries have missing data on other variables.[3] By matching all variables, we choose the final sample consisting with 70 economies and two subsamples (34 high-income economies [HIEs] and 46 low and middle-income economies [LMEs]) over the period 2006–2016 (see *Table A1*, Appendix, for the list of countries and data description of two subsamples). All variables, definitions, calculations and data description are presented in *Table 1*.

[insert Table 2 here]

4. Results and Discussion

Our sample has a large *N* (70 countries) over a relatively short-time period (2006–2016). So, the Pesaran's CD test Pesaran (2004) is employed to check the cross-sectional dependence. According to De Hoyos and Sarafidis (2006), cross-sectional dependence in the errors exists in panel-data estimates, which may be due to the presence of common shocks and unobserved components (Robertson and Symons, 2000, Pesaran, 2004). We also expect strong interdependencies in economic factors among countries in this highly integrated gobal economy. De Hoyos and Sarafidis (2006) explain that coefficient estimates of fixed and random effects panel data models are not consistent if there is correlation between regressors and unobserved components that creates interdependencies across cross-sections. In this case, Pesaran (2006) proposed the panel corrected standard errors (PCSE) as an appropriate estimate (De Hoyos and Sarafidis, 2006).

Results obtained from the CD test are incorporated in the last column of *Table 1*. The results indicate the existence of cross-sectional dependence in all the variables. In this

[3] Upon request, we can provide details about dropped countries and missing data.

context, the panel corrected standard errors model (PCSE) is argued as a robust estimator (Marques and Fuinhas, 2012, Jönsson, 2005, Bailey and Katz, 2011); thus, it is recruited as the primary estimator in this study. Furthermore, we also employ a set of alternative estimators, including feasible generalized least squares (FGLS), pooled OLS, robust pooled OLS, pooled OLS with year effects for robustness check.

More importantly, in this study, we employ techniques to ensure robustness, consistency, and unbiased results. Specifically, each control variable is added to the estimation one by one. The same procedure is applied for the subsamples. Also, we analyze different types of natural resource rents (besides total natural resource rents), including coal rents (*CoalR*), mineral rents (*MineR*), natural gas rents (*GasR*), and forest rents (*ForestR*).

[insert Table 3 here]

We report the main empirical results in Table 3, in which the coefficient estimates of ten different models are presented. Model (1) denotes a basic model, including our primary variable of excessive entrepreneurship (DUM1) along with income and its square term. Then, we add other control variables cumulatively to the basic model from Model (2) to (5); this is to check whether our results are subject to multicollinearity due to correlation between the variables. Model (5) represents a full model, including all the control variables. Models (1) to (5) show that estimations are not sensitive to included controls. So, we proceed to check whether empirical results are robust to alternative measures of excessive entrepreneurship in Models (7) to (10). Models (5) to (10) show that estimations are robust in measuring excessive entrepreneurship[4].

Regarding control variables, income level has a significant positive impact on natural resource rents while its square term has a significant negative impact, confirming the EKC hypothesis. When we investigate coal rents (*CoalR*), mineral rents (*MineR*), natural gas rents (*GasR*), and forest rents (*ForestR*) separately, we find an inverted U-shaped curve for coal rents. This finding contrasts with other types of rent, with a U-shaped curve for gas

[4] We also check the robustness of the results by adding institutional quality as a control variable; the results are consistent and robust. The detailed results are available on request.

rents and forest rents and a decreasing line for mineral rents (see Table A2-3 in Appendix). The inverted U-shape relationship in coal rents might be associated with the U-shape relationship in natural gas. As income increases, a country substitutes less environmentally damaging natural gas for more damaging coal in the production input mix (Stern, 2004, Canh et al., 2019, Phuc Nguyen et al., 2019). Regarding forest and mineral rents, the proportion of these resources in GDP decreases as a country develops from a primary industry-based economy to a manufacturing industry-based economy. However, wood products are demanded more as natural substitutes for plastic or other artificial products in consumption as income further increases.

Urbanization and FDI inflows have significant positive impacts, increasing natural resource rents. In contrast, trade openness has a significant negative impact on natural resource rents.

From now on, we will concentrate our discussion on excessive entrepreneurship. Estimations in *Table 3* show significant positive impacts of excessive entrepreneurship, as represented by dummy variables on natural resource rents; this implies that excessive entrepreneurship increases natural resource rents. Our results are robust for all six dummy variables, which are estimated obtained by different strategies. Thus, the results provide strong evidence of the negative impact of excessive entrepreneurship on natural resource rents.

Our results show that excessive entrepreneurial activity incentivizes entrepreneurs to seek natural resource rents; this confirms our presumption that too much entrepreneurial activity may harm the economy. Our results are in line with previous studies. For example, (Baumol, 2004) suggests that the adverse effect of excessive entrepreneurship stems from severe competition among entrepreneurs and between start-up firms and incumbent firms. (Prieger et al., 2016) show that technological progress stemming from large-scale R&D and scale economies may suffer when there are too many small entrepreneurs, lowering economic efficiency.

Too many entrepreneurs in the economy make them more opportunistic in securing survival and growth opportunities. Although our results are surprising, they are

deep-rooted. Subscribing to Prieger et al. (2016) and Lafuente et al. (2018), we propose that there is an optimal level of entrepreneurship yielding a balance between economic growth and environmental protection.

In this saying, findings in our study echo the thesis of the sustainable entrepreneurship literature, which argues that entrepreneurship does not follow the "more is better" principle. Also, it is important to encourage other types of entrepreneurship, such as social entrepreneurship and sustainable entrepreneurship, whose discovery, creation, and exploitation of opportunities to create future goods and services also sustain the natural and/or communal environment and provide development gain for others (Volkmann et al., 2019). Our findings also imply that to achieve sustainable society and economy, we should approach the concept of entrepreneurship not only from the neo-classical economic viewpoint (which highlights profit maximization) but also from the need to incorporate viewpoints from social science including co-evolution and co-creation (which emphasize collective sustainability).

Now we investigate the relationship between excessive entrepreneurship and natural resource rents for the two subsamples of HIEs and LMEs. Estimations in *Table 4* show the significant positive impact of excessive entrepreneurship on natural resource rents in HIEs. However, those in *Table 5* show the positive impact but with weaker statistical significance in LMEs, which implies that the natural rent-seeking of excessive entrepreneurship might be much significant in HIEs than in LMEs.

[insert Table 4, 5 here]

Our results are consistent with Prieger et al. (2016) and suggest that entrepreneurship is close to its optimal level in developed countries, whereas the level of entrepreneurship is much lower than its optimal rate in developing countries. That is, entrepreneurs are not excessive in number in LMEs. As another explanation, LMEs are so diverse in their abundance of natural resources that this produces the insignificance. For example, entrepreneurs do not have access to natural resources in some LMEs. Previous studies show that entrepreneurship heterogeneity among the country groups has not been fully investigated (Behrens et al., 2007). In this respect, this study acknowledges that

countries possess different entrepreneurship levels depending on the development phase, resulting in different degrees of natural rent-seeking.

Robustness check

To check the robustness of the empirical results, we first conduct a set of analysis on different types of natural resources, including coal, minerals, gas, and forest. Estimation results for different types of natural resource rents are reported in Table A2, A3, A4, Appendix.

Specifically, Table A2 presents estimations for coal rents and mineral rents. Table A3 and A4 show estimations for natural gas rents, forest rents, and oil rents, respectively. The estimations are consistent with our main findings and confirm the positive relationship between excessive entrepreneurship and natural resource rents. Specifically, the results show a set of consistent positive impacts of excessive entrepreneurship on mineral rents and forest rents, while there is weaker evidence of the effects of excessive entrepreneurship on coal rents and natural gas rents.

These findings indicate that natural resource rents are multidimensional, and entrepreneurs are keen on seeking rents from specific natural resources. Specifically, mineral rents and forest rents are most likely employed by entrepreneurs to build their competitive advantages since these resources are relatively accessible, especially in developing countries (Munasinghe et al., 2019, Elbra, 2013). Also, these two types of natural resources are crucial to many industry and production processes. As such, when the number of entrepreneurial activities exceeds the optimal level, they are keen on abusing these two kinds of resources to establish competitive advantages. Meanwhile, coal and gas are fuel and are strictly controlled by the states with careful management of the supply and demand (Towler et al., 2016, Lin and Liu, 2010). As such, when the number of entrepreneurial activities exceeds the optimal level, they are less likely to abuse these two types of resources.

Overall, our findings indicate that severe competition requires entrepreneurs to secure every opportunity for survival and growth. The consequence of this behaviour is that entrepreneurs become opportunistic, and they pursue higher natural resource rents as a result. Also, there is evidence that entrepreneurship is close to its optimal level in developed countries, whereas the level of entrepreneurship is much lower than its optimal rate in developing countries. Therefore, the pressure on natural resources rents is more substantial in developed countries than it is in developing countries. Finally, we find that entrepreneurs are more likely to seek mineral rents and forest rents under severe competition leaving coal rents and natural gas rents to a lesser extent.

5. Conclusions

Governments usually hold natural resources at an affordable price to support domestic firms. As competition intensifies, the marginal costs of both financial and human capital increase relative to those of natural resources. Firms facing severe competition seek more rent from natural resources as the number of entrepreneurs grows. Increasing natural resource rents harms the environment and economic sustainability. In this context, we investigate the impacts of excessive entrepreneurial activity on natural resource rents at the national level.

We test the proposed hypothesis using a global sample of 70 countries over 11 years (2006-2016) and find consistent evidence supporting the negative effects of excessive entrepreneurship on natural resource rents. Our findings are consistent across different specifications and estimation methods.

Our study makes three important contributions to the existing literature on ecological entrepreneurship. First, the study proposes that there is an optimal level of entrepreneurship which yields a balance between economic growth and environmental protection. Second, this study shows that the natural rent-seeking of excessive entrepreneurship is more significant in HIEs than in LMEs. Third, this study suggests that natural resource rents are multidimensional, and entrepreneurs prefer rents from specific resources among coal, minerals, gas, and forest.

Besides these contributions to ecological entrepreneurship, this study is also relevant to the literature examining sustainable and social entrepreneurship. Given that (too much) opportunistic entrepreneurship may boost natural resource rents and harm the environment, it is essential to encourage sustainable and social entrepreneurship that incorporate sustainability into their development ideology. While social entrepreneurship aims to solve social problems, sustainable entrepreneurship is more concerned with natural and environmental issues (Tiba et al., 2019). Unfortunately, the extant literature focuses more on explaining the precedents of creating social/sustainable businesses rather than examining their impact on the economy and society (Arru, 2020, Bischoff, 2019). Future studies may thus seek to investigate the relationship between sustainable entrepreneurship and natural resource rents or environmental protection. Understanding the contributions of sustainable entrepreneurship helps underpin its importance in mainstream literature.

The findings of this study are most relevant to policymakers concerned with boosting entrepreneurship while balancing environmental protection. Authorities should be aware of the existence of the optimal level of entrepreneurship. Excessive entrepreneurial activity adversely affects the sustainability of economic development since it incentivizes natural resource rent-seeking that harms the environments. In this sense, we recommend that policymakers focus on encouraging innovative and productive activities. By selectively supporting high value-added entrepreneurship, authorities can signal that not all venture activities are welcome; this will reduce unnecessary competition and moderate rent-seeking behaviour. Also, our findings imply that policymakers should consider the heterogeneity of types of natural resources and the levels of economic development when identifying the desired levels of entrepreneurship.

This study focuses on the impact of excessive entrepreneurship on natural resources rents, which are an important component of environmental resilience. The study indicates several research directions for future studies. First, new business density used in the study may be too broad and goes far beyond any definition of entrepreneurship activity. Specifically, there are differences in the characteristics of entrepreneurship

activities, i.e. high-tech entrepreneurship versus low-tech, profit-driven entrepreneurship versus sustainable entrepreneurship, or formal versus informal entrepreneurship.

The investigations on the impact of these different types of entrepreneurship will enrich the literature. Unfortunately, the data from the World Bank on entrepreneurship density is the best available, which limits further investigations. Second, future studies can expand concerns about the impact of excessive entrepreneurship activity to other aspects of the economy, such as environmental protection, social inequality and individual happiness. It would be of valueaable to consider the influence of excessive entrepreneurship activity on the survival of the economy in terms of these factors.

Our study presents a starting point for the literature of entrepreneurship and natural resources economics about the linkages between two factors. Further, the study offers a reflection on the balance between entrepreneurial activities and the need to protect natural resources in future studies. We challenge the long-lasting assumption that entrepreneurship is always good. Future studies might want to explore more about the "dark side" of entrepreneurship to yield relevant policy implications relating to boosting environments. This strand of research would make significant contributions to the literature of sustainable development.

Declaration of interests

☒ 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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Table 1. Estimations of excessive entrepreneurship

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep.var:	Log of Real GDP	Log of Entreprenership density	Log of Entreprenership density	Real economic growth	Log of Entreprenership density	Log of Entreprenership density	Log of Entreprenership density	Log of Entreprenership density
Economic growth (-1)				0.212*** [0.039]				0.007 [0.009]
Log of Entrepreneurship density (-1)		0.980***	0.979***		0.980***	0.979***	0.976***	
		[0.007]	[0.006]		[0.007]	[0.007]	[0.009]	
Output gap (-1)		-0.001 [0.001]						
Year	0.028 [0.020]							
Cyclical factor of real GDP (-1)			-1.482*** [0.298]					
Residual from economic growth (-1)					-0.003 [0.004]			
Log of real GDP per capita (-)							0.004 [0.009]	0.115* [0.063]
Unemployment rate (-)								0.061*** [0.007]
Log of human capital index (-1)								1.187*** [0.205]
Average of six institutional indicators (-)								0.362*** [0.105]
Economic freedom index (-)								0.039*** [0.007]
Constant	-29.844 [40.747]	0.039*** [0.010]	0.039*** [0.009]	4.769*** [0.932]	0.032*** [0.010]	0.040*** [0.010]	0.006 [0.077]	-4.842*** [0.665]
Observations	770	700	700	700	630	700	700	700
R-squared	0.002	0.969	0.970	0.550	0.968	0.969	0.969	0.575

*Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.*

Table 2. Variables, definitions, measurements, sources, data description and CD tests

Variable	Definitions	Measurements	Sources	Obs	Mean	SD.	Min	Max	CD-test
NRR	Natural resources rents	Total natural resources rents (% of GDP)	WDIs	770	3.47	5.10	0.00	32.55	38.50***
CoalR	Coal rents	Coal rents (% of GDP)	WDIs	770	0.19	0.60	0.00	7.85	30.44***
MineR	Mineral rents	Mineral rents (% of GDP)	WDIs	770	1.41	3.12	0.00	20.92	18.96***
GasR	Natural gas rents	Natural gas rents (% of GDP)	WDIs	770	0.32	0.76	0.00	4.89	22.84***
ForestR	Forest rents	Forest rents (% of GDP)	WDIs	770	0.50	0.97	0.00	8.58	10.41***
Income	Income level	Log of GDP per capita (constant 2010 US$)	WDIs	770	9.20	1.32	6.13	11.63	75.12***
Cap	Capital formation	Gross capital formation (% of GDP)	WDIs	766	24.43	5.86	12.32	44.31	31.01***
Urban	Urbanization	Urban population (% of total)	WDIs	770	65.04	18.80	15.46	100.00	82.15***
Trade	Trade openness	Trade (% of GDP)	WDIs	770	95.64	59.71	20.72	441.60	29.15***
FDI	FDI inflows	Foreign direct investment, net inflows (% of GDP)	WDIs	770	5.98	14.92	-58.32	252.31	23.46***
Data description for the estimations of excessive entrepreneurship									
Residual from model (1)				770	0.000	1.777	-3.343	3.392	
Output gap				770	-0.488	7.045	-15.123	11.751	
Residual from model (2)				700	0.000	0.227	-2.174	1.369	
Cyclical factor from HP filter for log of real GDP				770	0.000	0.029	-0.125	0.139	
Residual from model (3)				700	0.000	0.224	-2.191	1.385	
Residual from model (4)				700	0.000	2.529	-12.856	19.758	
Residual from model (5)				630	0.000	0.230	-2.158	1.396	
Residual from model (6)				700	0.000	0.228	-2.161	1.383	
Residual from model (7)				700	0.000	0.228	-2.154	1.388	
Residual from model (8)				700	0.000	0.848	-2.206	2.637	

Note: WDIs is World Development Indicators database, World Bank (version Apr/2019); Fred is economic database of Federal reserve system of St. Lousis (US); in CD test: Under the null hypothesis of cross-section independence, CD ~ N(0,1), p-values close to zero indicate data are correlated across panel groups.

Table 3. Excessive entrepreneurship and natural resources rents

Dep. var: ***NRR***	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Income	2.680***	3.461***	0.993*	-0.014	0.193	0.200	0.167	0.153	0.129	-0.544
	[0.698]	[0.588]	[0.547]	[0.515]	[0.467]	[0.451]	[0.476]	[0.469]	[0.463]	[0.498]
Income^2	-0.213***	-0.250***	-0.145***	-0.078***	-0.089***	-0.088***	0.087***	-0.087***	-0.085***	-0.049*
	[0.039]	[0.034]	[0.032]	[0.030]	[0.028]	[0.027]	[0.028]	[0.028]	[0.028]	[0.029]
DUM1	**0.760****	**0.687****	**0.670***	**0.724****	**0.710****					
	[0.363]	[0.334]	[0.343]	[0.361]	[0.356]					
DUM2						**0.770***				
						[0.408]				
DUM3							**0.730****			
							[0.365]			
DUM4								**0.617***		
								[0.338]		
DUM5									**0.605***	
									[0.330]	
DUM6										**2.538*****
										[0.342]
Cap		0.008	0.021	0.037	0.038	0.034	0.036	0.039	0.039	0.033
		[0.029]	[0.026]	[0.026]	[0.026]	[0.026]	[0.027]	[0.026]	[0.026]	[0.027]
Urban			0.053***	0.055***	0.054***	0.052***	0.054***	0.054***	0.054***	0.059***
			[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]
Trade				-0.014***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***
				[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
FDI					0.014**	0.014**	0.014**	0.015**	0.014**	0.010*
					[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.006]
Cons.	-3.268	-7.431***	2.405	6.619***	5.787***	5.810***	5.872***	5.986***	6.079***	7.964***
	[2.976]	[2.244]	[2.163]	[1.934]	[1.746]	[1.675]	[1.813]	[1.756]	[1.722]	[1.720]
Observations	770	766	766	766	766	766	766	766	766	766
R-squared	0.098	0.091	0.106	0.128	0.130	0.131	0.130	0.129	0.129	0.189
No. of countries	70	70	70	70	70	70	70	70	70	70

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Table 4. Excessive entrepreneurship and natural resources rents: high income economies

Dep. var: ***NRR***	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Income	-35.193***	-34.756***	-34.401***	-52.286***	-52.293***	-50.835***	-51.422***	-51.434***	-51.678***	-51.603***
	[1.883]	[2.051]	[1.805]	[2.718]	[2.711]	[2.544]	[2.360]	[2.534]	[2.308]	[2.245]
Income^2	1.702***	1.681***	1.639***	2.526***	2.527***	2.457***	2.484***	2.487***	2.497***	2.490***
	[0.092]	[0.099]	[0.088]	[0.134]	[0.133]	[0.125]	[0.116]	[0.125]	[0.114]	[0.112]
DUM1	**1.007****	**1.005****	**0.867****	**0.918****	**0.918****					
	[0.422]	[0.420]	[0.400]	[0.405]	[0.406]					
DUM2						**0.804****				
						[0.342]				
DUM3							**0.821****			
							[0.361]			
DUM4								**0.915****		
								[0.387]		
DUM5									**0.713***	
									[0.374]	
DUM6										**0.922****
										[0.371]
Cap		0.008	0.009	0.026**	0.026**	0.019	0.016	0.020*	0.024**	0.035**
		[0.018]	[0.010]	[0.013]	[0.013]	[0.012]	[0.011]	[0.011]	[0.012]	[0.017]
Urban			0.063***	0.067***	0.067***	0.067***	0.068***	0.067***	0.068***	0.075***
			[0.003]	[0.005]	[0.005]	[0.006]	[0.005]	[0.005]	[0.005]	[0.006]
Trade				-0.017***	-0.017***	-0.017***	-0.017***	-0.017***	-0.017***	-0.016***
				[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
FDI					-0.000	-0.001	-0.000	-0.000	0.000	-0.000
					[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Cons.	182.138***	179.652***	175.788***	266.743***	266.777***	259.414***	262.431***	262.297***	263.730***	262.639***
	[9.660]	[10.821]	[9.201]	[13.682]	[13.624]	[12.830]	[11.885]	[12.735]	[11.544]	[10.757]
Observations	374	374	374	374	374	374	374	374	374	374
R-squared	0.072	0.072	0.119	0.237	0.237	0.232	0.232	0.237	0.230	0.237
No. of countries	34	34	34	34	34	34	34	34	34	34

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Table 5. Excessive entrepreneurship and natural resources rents in low and middle income economies (LMEs)

Dep. var: ***NRR***	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Income	-4.994***	-5.405***	-7.521***	-6.236***	-6.073***	-7.234***	-7.078***	-7.081***	-6.599***	-1.626
	[1.506]	[1.562]	[2.039]	[2.096]	[1.834]	[1.618]	[1.631]	[1.631]	[1.739]	[2.211]
Income^2	0.335***	0.374***	0.485***	0.408***	0.408***	0.482***	0.473***	0.472***	0.440***	0.105
	[0.096]	[0.098]	[0.121]	[0.125]	[0.109]	[0.096]	[0.096]	[0.097]	[0.103]	[0.134]
DUM1	**1.341***	**1.209***	**1.203***	**1.206***	**1.075***					
	[0.705]	[0.645]	[0.640]	[0.636]	[0.627]					
DUM2						**0.484**				
						[0.689]				
DUM3							**0.475**			
							[0.706]			
DUM4								**0.333**		
								[0.588]		
DUM5									**0.854**	
									[0.567]	
DUM6										**3.739*** **
										[0.386]
Cap		0.000	0.010	0.014	-0.028	-0.025	-0.025	-0.024	-0.026	-0.058
		[0.037]	[0.037]	[0.038]	[0.038]	[0.037]	[0.037]	[0.037]	[0.037]	[0.041]
Urban			0.023***	0.021***	0.005	0.006	0.006	0.006	0.007	0.030***
			[0.007]	[0.007]	[0.009]	[0.007]	[0.007]	[0.007]	[0.008]	[0.007]
Trade				-0.008**	-0.020***	-0.020***	-0.020***	-0.020***	-0.020***	-0.029***
				[0.004]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.006]
FDI					0.345***	0.348***	0.347***	0.354***	0.345***	0.325***
					[0.094]	[0.094]	[0.095]	[0.095]	[0.093]	[0.080]
Cons.	22.768***	23.407***	31.709***	26.993***	27.314***	31.986***	31.339***	31.465***	29.467***	10.158
	[6.003]	[6.675]	[8.470]	[8.655]	[7.597]	[6.776]	[6.836]	[6.792]	[7.230]	[8.818]
Observations	396	392	392	392	392	392	392	392	392	392
R-squared	0.020	0.024	0.026	0.028	0.054	0.046	0.046	0.046	0.050	0.145
No. of countries	36	36	36	36	36	36	36	36	36	36

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Appendix

Table A1. List of countries

34 High income economies (HIEs)				
Australia	Denmark	Israel	New Zealand	Slovenia
Austria	Estonia	Italy	Norway	Spain
Belgium	Finland	Korea, Rep.	Panama	Sweden
Chile	France	Latvia	Poland	Switzerland
Croatia	Germany	Lithuania	Portugal	United Kingdom
Cyprus	Hungary	Luxembourg	Singapore	Uruguay
Czech Republic	Ireland	Netherlands	Slovak Republic	
36 Low and middle income economies (LMEs)				
Albania	India	Mauritius	Pakistan	Senegal
Armenia	Indonesia	Mexico	Paraguay	South Africa
Bolivia	Jamaica	Moldova	Peru	Tajikistan
Botswana	Jordan	Morocco	Philippines	Thailand
Brazil	Kazakhstan	Namibia	Romania	Turkey
Costa Rica	Kyrgyz Republic	Nepal	Russian Federation	Ukraine
Dominican Republic	Malaysia	Nigeria	Rwanda	Zambia
El Salvador				

Mean (Standard deviation) for subsamples				
Variable	High income economies		Low and middle-income economies	
NRR	1.47	(3.36)	5.35	(5.70)
CoalR	0.08	(0.29)	0.29	(0.77)
MineR	0.70	(2.88)	2.09	(3.19)
GasR	0.16	(0.46)	0.48	(0.94)
ForestR	0.20	(0.31)	0.77	(1.26)
Income	10.31	(0.64)	8.16	(0.87)
Cap	23.52	(5.26)	25.30	(6.26)
Urban	75.82	(12.81)	54.85	(17.87)
Trade	116.2	(73.7)	76.21	(32.08)
FDI	8.26	(20.97)	3.83	(2.98)
EnDen	1.42	(0.88)	-0.03	(1.26)

Notes: Number of observations are 374 and 396 for HIEs and LMEs, respectively.

Table A2. Excessive entrepreneurship and coal rents, mineral rents

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Var:				***CoalR***						***MineR***		
Income	0.646***	0.647***	0.646***	0.646***	0.647***	0.626***	-1.009***	-1.003***	-1.032***	-1.034***	-1.054***	-1.267***
	[0.063]	[0.063]	[0.064]	[0.064]	[0.063]	[0.057]	[0.351]	[0.343]	[0.361]	[0.362]	[0.358]	[0.382]
Income^2	-0.035***	-0.035***	-0.035***	-0.035***	-0.035***	-0.034***	-0.002	-0.001	-0.001	-0.001	0.001	0.012
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.017]	[0.017]	[0.018]	[0.018]	[0.018]	[0.019]
DUM1	**-0.011**						**0.523*** **					
	[0.036]						[0.150]					
DUM2		**-0.008**						**0.578*** **				
		[0.041]						[0.167]				
DUM3			**-0.025**						**0.487*** **			
			[0.039]						[0.153]			
DUM4				**-0.019**						**0.525*** **		
				[0.033]						[0.152]		
DUM5					**-0.019**						**0.517*** **	
					[0.035]						[0.154]	
DUM6						**0.083*** **						**0.769*** **
						[0.018]						[0.185]
Cap	0.012***	0.012***	0.012***	0.012***	0.012***	0.011***	0.074***	0.071***	0.073***	0.074***	0.074***	0.075***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]
Urban	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	0.060***	0.059***	0.060***	0.060***	0.060***	0.062***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Trade	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
FDI	0.001	0.001	0.001	0.001	0.001	0.001	0.011**	0.011**	0.011**	0.011**	0.011**	0.010**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Cons.	-2.726***	-2.729***	-2.719***	-2.724***	-2.727***	-2.681***	5.295***	5.304***	5.388***	5.403***	5.482***	6.187***
	[0.259]	[0.259]	[0.263]	[0.259]	[0.258]	[0.231]	[1.545]	[1.514]	[1.584]	[1.588]	[1.569]	[1.567]
Observations	766	766	766	766	766	766	766	766	766	766	766	766
R-squared	0.047	0.046	0.047	0.047	0.047	0.051	0.151	0.152	0.149	0.151	0.150	0.160
No. of countries	70	70	70	70	70	70	70	70	70	70	70	70

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Table A3. Excessive entrepreneurship and natural gas rents, forest rents

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Var:			***GasR***						***ForestR***			
Income	-0.283***	-0.281***	-0.282***	-0.285***	-0.285***	-0.359***	-2.004***	-2.005***	-2.008***	-2.006***	-2.008***	-2.075***
	[0.081]	[0.082]	[0.082]	[0.081]	[0.081]	[0.091]	[0.076]	[0.074]	[0.074]	[0.076]	[0.075]	[0.077]
Income^2	0.010**	0.010**	0.010**	0.010**	0.010**	0.014***	0.095***	0.095***	0.095***	0.095***	0.095***	0.099***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
DUM1	**0.021**						**0.049**					
	[0.057]						[0.056]					
DUM2		**0.034**						**0.040**				
		[0.055]						[0.056]				
DUM3			**0.049**						**0.019**			
			[0.049]						[0.051]			
DUM4				**-0.003**						**0.049**		
				[0.052]						[0.056]		
DUM5					**-0.001**						**0.042**	
					[0.051]						[0.056]	
DUM6						**0.284*** **						**0.251*** **
						[0.047]						[0.031]
Cap	-0.015***	-0.016***	-0.016***	-0.015***	-0.015***	-0.016***	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***
	[0.003]	[0.003]	[0.004]	[0.003]	[0.003]	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Urban	0.007***	0.007***	0.007***	0.007***	0.007***	0.008***	-0.002***	-0.002***	-0.001***	-0.002***	-0.002***	-0.001**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Trade	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
FDI	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Cons.	2.108***	2.100***	2.093***	2.125***	2.123***	2.307***	11.284***	11.294***	11.309***	11.294***	11.304***	11.483***
	[0.421]	[0.423]	[0.421]	[0.420]	[0.419]	[0.437]	[0.373]	[0.365]	[0.367]	[0.375]	[0.372]	[0.365]
Observations	766	766	766	766	766	766	766	766	766	766	766	766
R-squared	0.040	0.041	0.041	0.040	0.040	0.074	0.222	0.222	0.222	0.222	0.222	0.239
No. of countries	70	70	70	70	70	70	70	70	70	70	70	70

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Table A4. Excessive entrepreneurship and oil rents in full sample

Dep. var: ***NRR***	(1)	(2)	(3)	(4)	(5)	(6)
Income	6.314***	6.307***	6.346***	6.321***	6.322***	4.961***
	[0.601]	[0.604]	[0.560]	[0.607]	[0.609]	[0.542]
Income^2	-0.345***	-0.345***	-0.347***	-0.346***	-0.346***	-0.271***
	[0.033]	[0.033]	[0.031]	[0.033]	[0.034]	[0.030]
DUM1	0.072					
	[0.279]					

DUM2		0.094				
		[0.294]				
DUM3			0.251			
			[0.288]			
DUM4				0.032		
				[0.292]		
DUM5					0.019	
					[0.283]	
DUM6						1.580***
						[0.326]
Cap	-0.023	-0.023	-0.024	-0.023	-0.022	-0.029*
	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]
Urban	-0.033***	-0.034***	-0.034***	-0.033***	-0.033***	-0.032***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Trade	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
FDI	0.033***	0.032***	0.031***	0.033***	0.033***	0.023***
	[0.010]	[0.010]	[0.011]	[0.010]	[0.010]	[0.009]
Cons.	-22.494***	-22.463***	-22.689***	-22.508***	-22.511***	-17.219***
	[2.108]	[2.134]	[1.932]	[2.127]	[2.130]	[2.190]
Observations	495	495	495	495	495	495
R-squared	0.065	0.065	0.066	0.065	0.065	0.115
No. of countries	45	45	45	45	45	45

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Supplementary materials

Table S1. Excessive entrepreneurship and natural resources rents (robustness check with institutional quality as control variable)

Dep. var: ***NRR***	(1)	(2)	(3)	(4)	(5)	(6)
Income	-1.684***	-1.686***	-1.712***	-1.727***	-1.761***	-2.434***
	[0.484]	[0.482]	[0.505]	[0.492]	[0.488]	[0.564]
Income^2	0.117***	0.120***	0.119***	0.120***	0.122***	0.158***
	[0.025]	[0.026]	[0.027]	[0.026]	[0.026]	[0.034]
DUM1	0.811**					
	[0.342]					
DUM2		0.898**				
		[0.384]				
DUM3			0.827**			
			[0.362]			
DUM4				0.727**		
				[0.333]		

DUM5					0.734**	
					[0.327]	
DUM6						2.564***
						[0.370]
Cap	0.053**	0.048*	0.051*	0.053**	0.053**	0.048*
	[0.026]	[0.026]	[0.026]	[0.026]	[0.026]	[0.027]
Urban	0.050***	0.048***	0.050***	0.050***	0.049***	0.055***
	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]
Trade	-0.013***	-0.013***	-0.013***	-0.013***	-0.013***	-0.013***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
FDI	0.010**	0.010*	0.010*	0.010**	0.010**	0.006
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Inst	-3.119***	-3.139***	-3.115***	-3.117***	-3.127***	-3.110***
	[0.356]	[0.354]	[0.353]	[0.358]	[0.357]	[0.367]
Cons.	6.274***	6.291***	6.374***	6.489***	6.592***	8.543***
	[2.217]	[2.166]	[2.291]	[2.236]	[2.214]	[2.052]
Observations	766	766	766	766	766	766
R-squared	0.179	0.18	0.179	0.178	0.178	0.238
No. of countries	70	70	70	70	70	70

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Table S2. Excessive entrepreneurship and natural resources rents in HIEs (robustness check with institutional quality as control variable)

Dep. var: ***NRR***	(1)	(2)	(3)	(4)	(5)	(6)
Income	-52.671***	-51.702***	-51.934***	-51.935***	-52.196***	-52.015***
	[2.742]	[2.613]	[2.450]	[2.619]	[2.442]	[2.537]
Income^2	2.452***	2.406***	2.416***	2.418***	2.428***	2.417***
	[0.133]	[0.127]	[0.118]	[0.127]	[0.118]	[0.122]
DUM1	0.823**					
	[0.371]					
DUM2		0.587*				
		[0.305]				
DUM3			0.712**			
			[0.326]			
DUM4				0.798**		
				[0.352]		
DUM5					0.595*	
					[0.339]	
DUM6						0.854***
						[0.318]
Cap	0.039***	0.034**	0.031**	0.035***	0.038***	0.048**
	[0.015]	[0.014]	[0.013]	[0.013]	[0.014]	[0.019]
Urban	0.050***	0.051***	0.051***	0.050***	0.051***	0.057***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Trade	-0.016***	-0.016***	-0.016***	-0.017***	-0.017***	-0.016***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
FDI	0.002	0.002	0.002	0.002	0.002	0.002
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Inst	3.433***	3.383***	3.440***	3.419***	3.443***	3.456***
	[0.234]	[0.228]	[0.245]	[0.242]	[0.239]	[0.275]
Cons.	275.588***	270.663***	271.933***	271.727***	273.283***	271.702***
	[13.817]	[13.219]	[12.394]	[13.204]	[12.308]	[12.561]
Observations	374	374	374	374	374	374
R-squared	0.307	0.300	0.303	0.306	0.300	0.308
No. of countries	34	34	34	34	34	34

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

Table S3. Excessive entrepreneurship and natural resources rents in LMEs (robustness check with institutional quality as control variable)

Dep. var: ***NRR***	(1)	(2)	(3)	(4)	(5)	(6)
Income	-2.909*	-4.016**	-3.808**	-3.821**	-3.376**	0.650
	[1.705]	[1.653]	[1.631]	[1.621]	[1.665]	[1.983]
Income^2	0.351***	0.423***	0.410***	0.410***	0.380***	0.096
	[0.103]	[0.100]	[0.099]	[0.097]	[0.101]	[0.111]
DUM1	1.057*					
	[0.563]					
DUM2		0.678				
		[0.596]				
DUM3			0.651			
			[0.584]			
DUM4				0.454		
				[0.528]		
DUM5					0.892*	
					[0.496]	
DUM6						3.308***
						[0.344]
Cap	0.013	0.015	0.016	0.017	0.015	-0.016
	[0.036]	[0.035]	[0.035]	[0.035]	[0.035]	[0.040]
Urban	-0.025***	-0.024***	-0.024***	-0.024***	-0.023***	0.000
	[0.008]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
Trade	-0.002	-0.001	-0.002	-0.002	-0.002	-0.011**
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]
FDI	0.343***	0.342***	0.340***	0.350***	0.343***	0.327***
	[0.092]	[0.091]	[0.091]	[0.094]	[0.092]	[0.079]
Inst	-5.679***	-5.728***	-5.720***	-5.703***	-5.696***	-5.213***
	[0.599]	[0.608]	[0.610]	[0.612]	[0.596]	[0.651]
Cons.	3.055	7.328	6.486	6.733	4.926	-9.647
	[7.441]	[7.226]	[7.176]	[7.184]	[7.277]	[8.949]
Observations	392	392	392	392	392	392
R-squared	0.188	0.182	0.182	0.181	0.185	0.256
No. of countries	36	36	36	36	36	36

Note: standard errors are in []; *, **, *** are significant levels at 10%, 5%, and 1%, respectively.

[i] This meaning of rent or rent-seeking should be distinguished from Ricardian rent, which is a surplus earning above the costs necessary to till a scarce and fertile land. Even though being used to indicate inefficiency, Ricardian rent is seen as being "above-normal earnings" that remain even if the

economy is in equilibrium SAUTET, F. 2013. Local and systemic entrepreneurship: solving the puzzle of entrepreneurship and economic development. *Entrepreneurship: Theory and Practice*, 387..