


REVIEW

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# The impact of economic-related freedoms on the national entrepreneurial activity

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## Abstract

This article aims to analyze the explanatory power of the constituent components of the Heritage Foundation's Index of Economic Freedom over the Global Entrepreneurship and Development Institute's Global Entrepreneurship Index and its sub-indexes. We analyze a sample of 118 countries with available historic data from 2014–2019. We evaluate the impact of the business, labor, monetary, trade, investment, and financial freedom indexes over the Global Entrepreneurship Index and its sub-indexes. We performed a cross-sectional analysis using generalized linear models and weighted least squares models. We also analyzed our panel data using panel-corrected standard error models. We find a significant and positive relationship between the Global Entrepreneurship Index and the business and financial freedom indexes. We also find a significant and positive relationship between the business and financial freedom indexes and the entrepreneurial attitudes, abilities, and aspirations sub-indexes. The limitations of our study include the diversity of national entrepreneurial ecosystems and the difficulty of measuring them with a few quantitative variables. Additionally, our results are heavily influenced by the selection of countries in our sample. To the best of the authors' knowledge, no previous research article has studied the explanatory power of the Index of Economic Freedom's constituent components over the Global Entrepreneurship Index and its sub-indexes. Similarly, our sample of 118 countries with data from 2014–2019 makes our study the most comprehensive global analysis about the relationship between economic freedom and entrepreneurship so far.

**Keywords:** Economic freedom, Necessity entrepreneurship, Global Entrepreneurship Index, Index of Economic Freedom, Entrepreneurial ecosystems, Opportunity entrepreneurship

**Mathematics Subject Classification:** L26, Z18, J18, L38

## Introduction

On December 19, 2014, the United Nations (UN, 2016) General Assembly adopted resolution 69/210, recognizing the entrepreneurial activity's significant contribution to sustainable development by creating jobs and fostering economic growth and innovation. Entrepreneurship was considered as the driving force behind improvements in social conditions and adjustments to environmental challenges. In its report, the UN acknowledged the critical role of government policies in designing regulatory frameworks directly impacting entrepreneurship. National policies, laws,

and regulations can foster entrepreneurial activity by avoiding excessive controls, changing rules, high taxes, corruption, and unfair competition.

The International Monetary Fund also highlights the relationship between entrepreneurship and economic welfare. Indeed, Fouejieu et al. (2020) study a sample of 199 countries using data from 2006–2017 and find that the main drivers for the expansion of small and medium-sized enterprises (SMEs) are the business environment, institutional and economic stability, proper financial supervision and regulation, fair competition, credit information infrastructure, government effectiveness, and public sector size.

Similarly, the World Bank (2005) informed in a newsletter about the study of Klapper, Laeven, and Rajan, who analyze 34 countries in Eastern and Western Europe and find that entry regulations and high taxes jeopardize the formation of new business ventures. They also find that credit supply, particularly bank credit, is an essential factor in fostering national entrepreneurship and that superior property right protection fosters entrepreneurial entry in R&D intensive industries.

Previous academic research works have provided evidence about the relationship between entrepreneurship and economic growth and job creation (Baumol et al., 2007; Bjørnskov et al., 2016; Boudreaux & Caudill, 2019; Heckelman, 2000; Maradana et al., 2017; Pauceanu et al., 2018; Rypestøl, 2017). As a result, government authorities worldwide struggle to implement policies to enable entrepreneurship and harvest the tax benefits resulting from more rapid economic growth and subsequent job creation. Our research work examines the impact of economic-related freedoms on national entrepreneurial activity. Our article aims to shed light on an existing gap in the literature about how public policies influencing different economic-related freedom dimensions may impact entrepreneurial activity among countries worldwide. Our results may be crucial for decision-makers responsible for promoting national entrepreneurship, particularly top policymakers, managers, and planners from local/national government and business authorities. Our results may also help trigger national dialogues about government strategies and practices to improve one or more analyzed economic freedom constituent factors.

Our article's principal original contribution is analyzing the explanatory power of the Heritage Foundation's Index of Economic Freedom (IEF) dimensions on the national entrepreneurial activity using the Global Entrepreneurship Index (GEI) compiled by the Global Entrepreneurship and Development Institute (GEDI), a U.S.-based research organization engaged in studying the relationship between economic development and entrepreneurship. The GEI measures the nature and forces that shape national entrepreneurial ecosystems. The GEI is calculated based on three sub-indexes, namely the entrepreneurial attitudes (ATT) sub-index, the entrepreneurial abilities (ABT) sub-index, and the entrepreneurial aspirations (ASP) sub-index. No previous article exists using these dependent variables to study the relationship between entrepreneurship and economic freedom using generalized linear models and panel-corrected standard error models. Similarly, our sample of 118 countries with data from 2014–2019 makes our study the most global and comprehensive analysis of this entrepreneurship/economic freedom relationship done so far.

### Literature review

Several articles have studied the political and institutional environment's impact on entrepreneurship by analyzing the relationship between economic freedom and entrepreneurial activity. McMullen et al. (2008) study the relationships between ten factors of the Heritage Foundation's IEF, including the GDP per capita of 37 countries and their national opportunity-driven entrepreneurship (ODE) and necessity-driven entrepreneurship (NDE) as defined by the Global Entrepreneurship Monitor (GEM). They find that both ODE and NDE have a negative relationship with the GDP per capita but a positive one with labor freedom. They also find unique positive relationships between ODE and property rights and between NDE and the fiscal and monetary freedoms. Bjørnskov and Foss (2008) study the relationship between the Fraser Institute's IEF and entrepreneurship using GEM's data for a sample of 29 countries. They find that government size, monetary policy quality, and the overall national financial environment significantly affect the local entrepreneurial activity.

Díaz-Casero et al. (2012) study the impact of the Heritage Foundation's IEF over the GEM's index of entrepreneurial activity using data from 2002–2009. They analyze samples that range between 20 countries in 2000 and up to 53 countries in 2009 and find that government size and fiscal freedom positively correlate with the Index of Total Entrepreneurial Activity, NDE, and ODE. Correspondingly, Gardner et al. (2014) study the relationship between entrepreneurship, measured by the GEM and the Heritage Foundation's IEF during 2005. They find a statistically significant relationship between economic freedom and entrepreneurial activity. Similarly, Kuckertz et al. (2016) study the impact of the four constituent factors of the Heritage Foundation's IEF over the entrepreneurial activity in a sample of 63 countries using fuzzy-set qualitative comparative analysis and GEM data. They find that the economic freedom factors' effects vary depending on the development stage of the country and the type of entrepreneurial activity: NDE versus ODE.

Nyström (2008) studies the relationship between self-employment as a measure of entrepreneurship and the Fraser Institute's IEF and its components. She uses self-employment rates harmonized for 23 OECD countries and the IEF's five areas of institutional quality, namely government size, legal structure and property right's security, access to sound money, freedom to trade internationally, and regulation of credit, labor, and businesses. She finds that a smaller government sector has a positive impact on self-employment. She also finds that superior legal structure, security of property rights, and less strict regulation on credit, labor, and businesses all have a positive relationship with self-employment. Likewise, Ghosh and Hall (2018) study the relationship between economic freedom and entrepreneurship by analyzing 41 developing countries with GEM data on entrepreneurial intentions and data on the Fraser Institute's IEF. They find that freedom to trade internationally is related to lower levels of entrepreneurial orientation. They also find that higher quality of legal systems, security of property rights, and flexible labor regulations are associated with higher entrepreneurial intention levels.

Saunoris and Sajny (2017) study the impact of economic freedom on the average prevalence of formal and informal entrepreneurship. They use data on 60 countries retrieved from the GEM Adult Population Survey, the World Bank Entrepreneurship Snapshot data set, and the Heritage Foundation's IEF. They find a significant relationship between

economic freedom and formal and informal entrepreneurship. They conclude that economic freedom promotes formal entrepreneurship and legitimate business startups; however, economic freedom can also be effective in countries with high prevalence rates of informal entrepreneurship. Similarly, Erkut (2016) tries to determine the relationship between entrepreneurship and economic freedom using the GEM data and the Heritage Foundation's IEF data. Using a direct discriminant analysis on 53 countries, he finds that intellectual property rights, quick utility access, a well-functioning bureaucracy, and government support for entrepreneurs significantly impact entrepreneurship. Likewise, Herrera-Echeverri et al. (2014) conduct a panel study of data from 2004 to 2009 for 87 countries to determine the relationships among business creation, institutional quality, market freedom, and foreign direct investment. Using data from the World Bank Entrepreneurship Snapshot, they find a significant positive correlation between institutional quality and the rate of business creation. They also find that the freedom to create businesses and investment has the most significant positive impact on company development in emerging countries, while international trade significantly affects the low-income countries' business generation.

Some studies have conflicting results regarding the relationship between economic freedom and entrepreneurship. Indeed, Ridderstedt (2014) studies the impact of six components of the Fraser Institute's IEF over two GEM variables related to startups' owners-managers. Using a sample of 48 countries, he analyzes six economic freedom-related dimensions: security of property rights, freedom from regulations, size of government, freedom from taxation, openness to international trade and investment, and the summary rating of economic freedom. Using a set of ordinary least-square regressions, he finds no evidence of a significant relationship between the IEF's sub-components and entrepreneurship. Similarly, Sobel et al. (2007) study the impact of economic freedom on total entrepreneurial activity. They use a cross-section of 21 OECD countries with GEM data on total entrepreneurial activity and Fraser Institute's IEF data. They find that countries with the highest economic freedom scores had a 12% higher level of total entrepreneurial activity, but they also have a business failure rate that is almost twice that of the countries with the lowest economic freedom scores.

Angulo-Guerrero et al. (2017) conduct a panel data dynamic analysis in 29 OECD countries from 2001–2012 to study the impact of the Fraser Institute's IEF and its components on both GEM indicators: ODE and NDE. They find that a superior legal system and property rights, and more regulations on credit, labor, and business positively impact ODE and negatively impact NDE. Equally, Dempster and Isaacs (2017) study the relationship between productive and unproductive entrepreneurial activities as moderated by economic freedom. They analyze 47 countries from 2001–2011 using GEM and Fraser Institute's IEF data. They find that corruption control positively affects entrepreneurship. They also find that some elements of economic freedom, such as smaller government and low trade restrictions, also have a positive relationship with entrepreneurial activity; however, other elements such as legal enforcement and property rights hurt entrepreneurial activity.

Country-level analyses have also been performed to study the relationship between economic freedom and entrepreneurship. Indeed, Shishir and Plemmons (2021) study the relationship between the U.S. state-level startup entrepreneurship activity and its

economic freedom proxied by the North America Fraser Institute's IEF from 2005 to 2015. They find a positive relationship between the labor market's regulatory freedom and startup entrepreneurship density. Similarly, Steven and Russell (2005) study the relationship between U.S. entrepreneurial activity and the quantity of venture capital (VC). They apply U.S. state-level panel causality tests to two metrics of entrepreneurial activity (sole proprietorship and patent activity) and VC investment. They find a one-way causal relationship from entrepreneurial activity to VC investment, suggesting that VC investors focus on U.S. states with well-established entrepreneurial communities.

Likewise, Gohmann et al. (2013) analyze the impact of economic freedom on the U.S. service sector's entrepreneurial activity using the North America Fraser Institute's IEF from 1990–2009. They find that economic freedom positively impacts entrepreneurship in the sectors of finance, insurance, management, professional and technical services proxied by the number of workers employed in these industry sectors. They also find employment increases in the sectors of accommodation, food, health care, and social assistance when the economic freedom improves. Likewise, Campbell and Rogers (2007) find a significant positive relationship between economic freedom and business formation using the North America Fraser Institute's IEF from 1990–2001.

At the regional level and outside the U.S., Saberi and Hamdan (2019) study the government influence on the relationship between entrepreneurship and economic growth among the six Gulf Cooperation Council's countries. They find that government support proxied by administration effectiveness and regulatory quality has a significant moderating influence on the relationship between entrepreneurship and economic growth.

None of the articles summarized above provides an inclusive view on the relationship between entrepreneurship and economic freedom in a global context. Our article is the most comprehensive analysis in terms of time and locations with a sample of 118 countries and data from 2014–2019. The limited existing analysis on this topic may explain the mixed results referenced above. Additionally, no previous article has provided robust results from using different methodologies yielding consistent results. Our study is the first to apply generalized linear models and panel-corrected standard error models with reliable results. Finally, no previous article has ever analyzed the GEI data, which constitutes another original contribution. These facts allow us to derive meaningful inferences from our results and fill a gap derived from previous studies' small sample, limited methodology, and use of similar data.

## Methods

We measure entrepreneurial activity using data on the GEI and its three sub-indices: entrepreneurial attitudes, abilities, and aspirations sub-indexes. GEDI calculates these sub-indices using 14 pillars, each containing an individual and an institutional dimension corresponding to domestic entrepreneurship's micro and macro-level features.

The ATT sub-index measures how a country's people think about entrepreneurship. The ATT is based on the following pillars: opportunity perception, startup skills, risk acceptance, networking, and cultural support. The ABT sub-index quantifies the national entrepreneurial skills. The ABT includes the following pillars: opportunity startup, technology absorption, human capital, and local competition. Finally, the ASP

sub-index includes the following pillars: product and process innovation, high-growth businesses, internationalization, and risk capital.

Values for our economic freedom-related variables were retrieved from the individual components of the Heritage Foundation's IEF (HF, 2020). This index is calculated using 12 numerical factors, categorized into four comprehensive dimensions: the rule of law (it encompasses property rights, government honesty, and court of law efficiency) and government magnitude (it includes government expending, tax burden, and fiscal stability). The last two dimensions are regulatory framework proficiency (it comprises business, labor, and monetary freedoms) and open markets (it contains trade, investment, and financial freedoms). We only consider these last two dimensions in our study. Therefore, our freedom-related independent variables include the business freedom index (IVAR<sub>1</sub>), the labor freedom index (IVAR<sub>2</sub>), the monetary freedom index (IVAR<sub>3</sub>), the trade freedom index (IVAR<sub>4</sub>), the investment freedom index (IVAR<sub>5</sub>), and the financial freedom index (IVAR<sub>6</sub>).

The business freedom index measures the constraints levied by national regulatory and infrastructure environments on efficient business operations. This index comprises several metrics related to starting and closing a business, obtaining a license, and getting electric power, like the applicable process, time, cost, minimum capital, and recovery ratio.

The labor freedom index involves several legal framework metrics of a country's labor market. This index includes the ratio of the minimum wage to the average value-added per employee, obstacles to hiring additional employees, inflexibility of hours, struggles to fire employees, legally obligatory notice period, and compulsory severance pay. The monetary freedom index computes inflation and government actions that may produce distorted prices on goods and services. The trade freedom index measures the tariff and nontariff barriers' impact on exports and imports of goods and services. This index contains the trade-weighted average tariff ratio and a qualitative evaluation of nontariff barriers. The investment freedom index evaluates the quality and quantity of domestic restrictions to the flow of investment capital, such as limitations to access foreign exchange, payments, transfers, and capital transactions.

The financial freedom index assesses the national banking efficiency and independence from government influence and interference in the financial sector. This index measures five broad dimensions, namely the legal restrictions of financial services, the government meddling in the financial sector through direct and indirect ownership, government influence on credit allocation, the degree of financial and capital market development, and the country's openness to foreign competition in its financial sector.

We applied generalized linear models to analyze our cross-sectional data, which consist of a linear predictor  $\eta_i = \beta_0 + \beta_1 \text{IVAR}_{1i} + \dots + \beta_p \text{XIVAR}_{ni}$ ; and two equations, namely a link equation that depicts how the mean  $E(\text{DVAR}_i) = \mu_i$ , is a function of the linear predictor  $g(\mu_i) = \eta_i$ ; and a variance equation that explains how the variance,  $\text{var}(\text{DVAR}_i)$  relies on the mean  $\text{var}(\text{DVAR}_i) = \phi V(\mu)$ , where the distribution parameter  $\phi$  is a constant. For our general linear models, we have  $\epsilon = N(0, \sigma^2)$ , where the linear predictor  $\eta_i$  was defined above, the link equation  $g(\mu_i) = \mu_i$ , and the variance equation  $V(\mu_i) = 1$ . We also applied weighted least squares models to analyze the relationship between our dependent and independent variables. If the linear model

$DVAR_i = \beta_0 + \beta_1 IVAR_1 + \beta_2 IVAR_2 + \dots + \beta_k IVAR_n + u_i$  has a heteroskedastic variance  $\text{var}(u_i) = \sigma_i^2$ , we can divide each term by the weight  $\omega_i = 1/\sigma_i$ , to correct the independent variables and transform the initial function into  $\omega_i DVAR_i = \beta_0 \omega_i + \beta_1 (IVAR_1 \omega_i) + \beta_2 (IVAR_2 \omega_i) + \dots + \beta_k (IVAR_n \omega_i) + u_i \omega_i$ ; which is the equivalent to  $DVAR_i^* = b_0 IVAR_{0i}^* + b_1 IVAR_{1i}^* + b_2 IVAR_{2i}^* + \dots + b_n IVAR_{ni}^* + u_i^*$ ; but with homoscedastic variance  $\text{var}(u_i^*) = \text{var}(u_i/\sigma_i) = \text{var}(u_i)/\sigma_i^2 = 1$ .

Finally, we also analyze our data using the panel-corrected standard error model proposed by Beck and Katz (1995). The panel-corrected standard error estimates are robust to heteroskedasticity, contemporaneous cross-sectional correlation, and autocorrelation problems. Our time-series cross-section model can be represented as follows:  $y_{i,t} = \beta x_{i,t} + \epsilon_{i,t}$ ; where  $i = 1, \dots, N$ ;  $t = 1, \dots, T$ , and  $x_{i,t}$  is a vector of our independent variables indexed by cross-sections ( $i$ ) and years ( $t$ ). The variability of the OLS estimates from this function can be represented as follows:  $\text{Cov}(\hat{\beta}) = (X^T X)^{-1} [X^T \Omega X] (X^T X)^{-1}$ . If the errors follow a spherical error assumption, then  $\Omega = \sigma^2 \Phi$ , where  $\Phi$  is an  $NT \times NT$  identity matrix and the standard errors are determined by the square roots of the diagonal terms of  $\widehat{\sigma^2} (X^T X)^{-1}$ , where  $\widehat{\sigma^2}$  is the ordinary least squares estimator of common error variance  $\sigma^2$ . When panel models have heteroskedastic and contemporaneously correlated errors,  $\Omega$  is a  $NT \times NT$  diagonal matrix with an  $N \times N$  matrix of contemporaneous covariances  $\Pi$  over its diagonal. An element of this matrix can be determined by  $\widehat{\Pi}_{i,j} = \sum_{t=1}^{T_{ij}} e_i e_{j,t} / T_{i,j}$ . This function can be used to establish the estimator  $\widehat{\Omega}$  by generating a block diagonal matrix with  $\widehat{\Pi}$  matrices along the diagonal. Our balanced panel data allow us to simplify such matrices as follows:  $\widehat{\Pi} = (\psi^T \psi) / T$ , where  $\psi$  is the  $T \times N$  matrix of residuals and therefore can be estimated by  $\widehat{\Omega} = \widehat{\Pi} \otimes I_T$ , where  $\otimes$  is the Kronecker matrix product. The panel-corrected standard error can be determined by taking the square root of its diagonal elements  $(X^T X)^{-1} X^T \widehat{\Omega} X (X^T X)^{-1}$ .

## Results

Table 1 shows the cross-sectional analysis of our sample's GEI. The results show a significant and positive relationship between the GEI and the business and the financial freedom indexes during 2014–2016 and 2019. Similarly, the table shows a positive and significant relationship between the GEI and the trade freedom index from 2014–2016.

Table 2 shows the cross-sectional analysis of our sample's ATT sub-index. The results show a significant and positive relationship between the ATT sub-index and the business freedom index during 2014–2019. Likewise, the table shows a positive and significant relationship between the ATT sub-index and the financial freedom index during 2014–2016 and 2019. The table also shows a positive and significant relationship between the GEI and the monetary freedom index (in 2016 only), the trade freedom index (in 2016 and 2015 only), and the investment freedom index (in 2015 only). However, the lack of consistent and significant results in most years for these last three results suggests that these may be spurious outcomes.

Table 3 shows the cross-sectional analysis of our sample's ABT sub-index. The results show a significant and positive relationship between the ABT sub-index and the business freedom index during 2014–2019. Equally, the table provides evidence of a positive and significant relationship between the ABT sub-index and the financial freedom index during 2014–2016 and 2018–2019.

**Table 1** Cross-sectional analysis of the Global Entrepreneurial Index (GEI)

Years	2019	2018	2017	2016	2015	2014
Constant	− 46.336	− 13.81	− 16.44	− 44.11	− 38.19	− 28.92
<i>t</i> -sta	− 4.187	− 0.804	− 0.887	− 4.010	− 3.276	− 2.478
<i>p</i> -val	(0.0)****	(0.423)	(0.38)	(0.0)****	(0.001)***	(0.015)**
IVAR1	0.753	0.235	0.189	0.761	0.592	0.526
<i>t</i> -sta	6.77	1.348	1.208	8.403	7.029	6.704
<i>p</i> -val	(0.0)****	(0.18)	(0.23)	(0.0)****	(0.0)****	(0.0)****
IVAR2	0.092	− 0.08	− 0.014	0.061	0.031	0.088
<i>t</i> -sta	1.146	− 0.611	− 0.112	0.888	0.504	1.510
<i>p</i> -val	(0.25)	(0.54)	(0.91)	(0.38)	(0.62)	(0.13)
IVAR3	− 0.155	0.062	0.036	− 0.17	− 0.041	− 0.216
<i>t</i> -sta	− 1.142	0.297	0.154	− 1.124	− 0.229	− 1.150
<i>p</i> -val	(0.26)	(0.77)	(0.88)	(0.26)	(0.82)	(0.25)
IVAR4	0.203	0.244	0.305	0.376	0.352	0.378
<i>t</i> -sta	1.237	0.968	1.174	2.646	2.443	2.747
<i>p</i> -val	(0.22)	(0.33)	(0.24)	(0.009)***	(0.02)**	(0.007)***
IVAR5	0.060	− 0.009	− 0.013	− 0.054	− 0.039	− 0.041
<i>t</i> -sta	0.647	− 0.06	− 0.095	− 0.690	− 0.52	− 0.558
<i>p</i> -val	(0.52)	(0.95)	(0.92)	(0.49)	(0.61)	(0.58)
IVAR6	0.324	0.25	0.225	0.251	0.253	0.295
<i>t</i> -sta	3.02	1.563	1.388	2.75	2.830	3.401
<i>p</i> -val	(0.003)***	(0.12)	(0.17)	(0.007)***	(0.006)***	(0.0)****

\*\*\*\*, \*\*\*, \*\* and \* denote statistical significance at the 0.1%, 1%, 5%, and 10% significance level, respectively. The table contains *t*-statistic and their corresponding *p*-values below in brackets

Table 4 shows the cross-sectional analysis of our sample's ASP sub-index. The results show a significant and positive relationship between the ASP sub-index and the business freedom index during 2014–2019. Correspondingly, the table provides evidence of a positive and significant relationship between the AST sub-index and the trade freedom index (in 2014 and 2016–2017) and the financial freedom index (in 2019, 2016 and 2014).

Table 5 has the results for our panel-corrected standard error regression models. The table shows a significant and positive relationship between all our dependent variables (GEI, ATT, ABT, and ASP) and the business and financial freedom indexes. In the same way, the results show a positive and significant relationship between the trade freedom index and the GEI and its ABT and ASP sub-indexes. These results are consistent with those of Tables 1, 2, 3 and 4.

The UN Human Development Index (HDI) aims to assess the level of country development beyond economic progress alone. It encompasses three dimensions: health, education, and standard of living. The national life expectancy measures the health dimension. The education dimension is measured by the average schooling years of adults aged + 25 and the children's expected schooling time. The gross national income per capita measures the standard of living dimension. We use this HDI to identify countries with the highest proportion of ODE and NDE.

We assume that countries with high HDIs must have a predominance of ODE while those with low HDIs must have a NDE prevalence. This assumption is consistent



**Table 2** Cross-sectional analysis of the Entrepreneurial Attitudes Sub-Index (ATT)

Years	2019	2018	2017	2016	2015	2014
Constant	− 20.87288	− 4.698316	− 8.315991	− 8.408643	− 15.15999	− 1.658035
t-sta	− 2.117054	− 0.386458	− 0.689279	− 0.714925	− 0.942209	− 0.121173
p-val	(0.037)**	(0.69)	(0.492)	(0.476)	(0.348)	(0.904)
IVAR1	0.707735	0.437032	0.385617	0.788264	0.580571	0.475519
t-sta	7.241338	3.059907	2.872939	7.583309	6.045905	6.300245
p-val	(0.0)****	(0.003)***	(0.005)***	(0.0)****	(0.0)****	(0.0)****
IVAR2	0.069054	− 0.203888	− 0.14626	0.038022	0.090246	0.055295
t-sta	0.915951	− 1.944662	− 1.275491	0.491995	1.532235	1.046108
p-val	(0.362)	(0.054)*	(0.205)	(0.624)	(0.128)	(0.298)
IVAR3	− 0.206718	− 0.006316	0.008076	− 0.583346	− 0.530543	− 0.295924
t-sta	− 1.292598	− 0.045444	0.046375	− 3.17377	− 1.929317	− 1.297483
p-val	(0.199)	(0.964)	(0.963)	(0.002)***	(0.056)*	(0.197)
IVAR4	0.025886	0.158315	0.190094	0.292646	0.465009	0.202072
t-sta	0.205182	0.759112	0.937417	2.05498	3.1221	1.735551
p-val	(0.838)	(0.449)	(0.351)	(0.042)**	(0.002)***	(0.085)
IVAR5	0.104255	0.038507	0.046231	0.013395	− 0.196304	− 0.092968
t-sta	1.495172	0.412845	0.497922	0.248765	− 2.648672	− 1.542205
p-val	(0.138)	(0.681)	(0.619)	(0.804)	(0.009)***	(0.126)
IVAR6	0.219121	0.132035	0.112971	0.231741	0.446261	0.307978
t-sta	2.472588	1.213041	0.975529	2.644787	3.950371	2.954759
p-val	(0.015)**	(0.228)	(0.331)	(0.009)***	(0.0)****	(0.004)***

\*\*\*\*, \*\*\*, \*\* and \* denote statistical significance at the 0.1%, 1%, 5%, and 10% significance level, respectively. The table contains t-statistic and their corresponding p-values below in brackets

with Nikolaev et al. (2018) when considering the HDI as a valid proxy of income inequality. Indeed, they find that countries with severe income inequalities show higher levels of NDE and low levels of ODE. Based on this premise, we calculate the HDI's average from 2014–2019 for each country in our sample. We then rank these countries by their HDI averages from lowest to highest and identify the first (top) and fourth (bottom) quartiles. We then apply our panel-corrected standard error analysis again. We retrieve HDI data from the UN Development Programme's (2021) website.

Table 6 shows the results of our panel-corrected standard error regression models for the identified top and bottom quartiles (30 countries each) based on their HDI averages. The results show that countries in the top HDI quartile have a negative and significant relationship between all our dependent variables (GEI, ATT, ABT and ASP) and the monetary freedom index, but a positive and significant relationship with the financial freedom index. These results also show a positive and significant relationship between the investment freedom index and the GEI and its ABT sub-index. Regarding the countries in the bottom HDI quartile, the results provide evidence of a positive and significant relationship between all our dependent variables (GEI, ATT, ABT, and ASP) and the business freedom index, the trade freedom index excluding the ATT sub-index, and the financial freedom index excluding the ABT sub-index.

**Table 3** Cross-sectional analysis of the Entrepreneurial Abilities Sub-Index (ABT)

Years	2019	2018	2017	2016	2015	2014
Constant	− 30.5601	− 22.36608	− 26.58055	− 34.21493	− 20.25978	− 11.80945
t-sta	− 3.496198	− 2.03323	− 2.210132	− 3.35107	− 2.203921	− 1.31163
p-val	(0.0)****	(0.044)**	(0.029)**	(0.001)***	(0.029)**	0.1924
IVAR1	0.706178	0.261796	0.249546	0.798922	0.598092	0.3881
t-sta	6.467921	1.944261	1.767035	10.01616	6.732546	4.941215
p-val	(0.0)****	(0.05)**	(0.04)**	(0.0)****	(0.0)****	(0.0)****
IVAR2	0.114169	− 0.015065	0.015072	0.079667	− 0.05243	0.070279
t-sta	1.57631	− 0.150269	0.140353	1.374479	− 0.799117	1.61085
p-val	(0.118)	(0.881)	(0.888)	(0.172)	(0.426)	(0.1101)
IVAR3	− 0.186827	0.042305	0.074196	− 0.042937	0.227119	− 0.031706
t-sta	− 1.463501	0.333785	0.485255	− 0.40674	1.384032	− 0.196225
p-val	(0.146)	(0.739)	(0.629)	(0.685)	(0.169)	(0.845)
IVAR4	0.032691	0.31669	0.350712	0.111143	− 0.054882	0.144519
t-sta	0.226599	1.579602	1.721175	0.81984	− 0.475216	1.267171
p-val	(0.821)	(0.117)	(0.088)*	(0.414)	(0.636)	(0.208)
IVAR5	0.075438	0.008243	− 0.0124	− 0.037764	0.027865	− 0.05917
t-sta	1.072944	0.084815	− 0.134301	− 0.995315	0.517053	− 1.460726
p-val	(0.286)	(0.933)	(0.893)	(0.322)	(0.606)	(0.147)
IVAR6	0.322538	0.207335	0.1872	0.180812	0.166274	0.292075
t-sta	3.399258	1.917472	1.621052	2.480774	2.188016	4.953827
p-val	(0.0)****	(0.05)**	(0.108)	(0.015)**	(0.031)**	(0.0)****

\*\*\*\*, \*\*\*, \*\* and \* denote statistical significance at the 0.1%, 1%, 5%, and 10% significance level, respectively. The table contains t-statistic and their corresponding p-values below in brackets

## Discussion

Ács et al. (2019) explain the GEDI's definition of an entrepreneurial ecosystem as a "... dynamic institutionally embedded interaction between entrepreneurial attitudes (ATT), abilities (ABT) and aspirations (ASP), by individuals, which drives the allocation of resources through the creation and operation of new ventures..." (Ács et al., 2019, p. 3). This definition encompasses the notion of ODE rather than NDE. This definition also considers that ODE has explanatory power over economic growth. NDE can be the driven force behind the low-income countries' high self-employment rates. Indeed, these authors mention Zambia and Nigeria as examples of low-income economies with high levels of NDE, where many people lacking formal employment opportunities sell drinks or fruits on the street corners to survive. The GEI is the GEDI's tool to assess national entrepreneurial ecosystems that can help create local job opportunities. Under the previous definition of the entrepreneurial ecosystem and according to our results, the institutional interaction measured by the business and financial freedom indexes represents the IEF's quantitative constituent factors that have the most significant positive impact on national entrepreneurial ecosystems measured by the GEI.

Indeed, our results provide evidence of a strong relationship between the GEI, including all its sub-indexes, and the business freedom indexes. The business freedom index's calculation includes the following 13 factors: number of procedures and days to start a business; cost and minimum capital for starting a business; the number of procedures, days, and cost for obtaining a license; time to close a business and its

**Table 4** Cross-sectional analysis of the Entrepreneurial Aspirations Sub-Index (ASP)

Years	2019	2018	2017	2016	2015	2014
Constant	− 38.87971	− 24.11074	− 28.50835	− 54.80938	− 42.32199	− 41.99226
t-sta	− 3.230063	− 1.804461	− 1.957052	− 4.225693	− 3.577643	− 2.830151
p-val	(0.002)***	(0.074)*	(0.053)*	(0.0)****	(0.0)****	(0.006)***
IVAR1	0.624085	0.313348	0.291213	0.695279	0.468786	0.650617
t-sta	4.492429	2.198046	2.17626	6.432205	3.867361	5.939112
p-val	(0.0)****	(0.03)**	(0.032)**	(0.0)****	(0.0)****	(0.0)****
IVAR2	0.040289	− 0.124052	− 0.138655	0.128002	0.041622	0.230729
t-sta	0.436491	− 1.011352	− 1.05111	1.593692	0.505772	3.314077
p-val	(0.663)	0.314	(0.296)	(0.114)	(0.614)	(0.001)***
IVAR3	− 0.110261	0.073319	0.13066	− 0.025167	0.282854	− 0.421954
t-sta	− 0.626342	0.549774	0.78426	− 0.191813	1.550379	− 1.958494
p-val	(0.532)	0.5836	(0.435)	(0.848)	(0.124)	(0.053)*
IVAR4	0.296264	0.443427	0.486675	0.403123	0.208355	0.51841
t-sta	1.498589	1.878899	2.165558	2.084685	1.28917	3.574568
p-val	(0.137)	(0.063)*	(0.033)**	(0.039)**	(0.2)	(0.0)****
IVAR5	− 0.000773	− 0.03644	− 0.104786	− 0.142185	− 0.012491	− 0.015594
t-sta	− 0.007638	− 0.335155	− 1.006503	− 2.026323	− 0.138969	− 0.212224
p-val	(0.994)	(0.738)	(0.316)	(0.05)*	(0.889)	0.8323
IVAR6	0.271786	0.138234	0.170663	0.303523	0.190728	0.258736
t-sta	2.163861	0.945688	1.161	3.072445	1.928602	3.089281
p-val	(0.033)**	(0.3464)	(0.248)	(0.003)***	(0.056)*	(0.003)***

\*\*\*\*, \*\*\*, \*\* and \* denote statistical significance at the 0.1%, 1%, 5%, and 10% significance level, respectively. The table contains t-statistic and their corresponding p-values below in brackets

**Table 5** Correlated panel corrected standard error regression results

	Constant	IVAR1	IVAR2	IVAR3	IVAR4	IVAR5	IVAR6
GEI							
Coefficient	− 26.9	0.481	− 0.002	− 0.05	0.313	− 0.006	0.28
t-sta	− 3.36	5.822	− 0.034	− 0.545	3.026	− 0.093	3.592
p-val	(0.0)****	(0.0)****	(0.97)	(0.59)	(0.003)***	0.93	(0.0)****
ATT							
Coefficient	− 14.934	0.418	− 0.0166	− 0.0189	0.1323	0.0151	0.2624
t-sta	− 0.8222	3.224	− 0.1894	− 0.333	1.2979	0.3159	7.0683
p-val	0.411	(0.001)***	0.849	0.739	0.195	0.752	(0.0)****
ABT							
Coefficient	− 32.65	0.4208	0.0024	− 0.0073	0.3532	− 0.0373	0.299
t-sta	− 2.0996	2.9348	0.0488	− 0.1638	4.6228	− 1.5860	5.891
p-val	(0.036)**	(0.003)***	0.961	0.87	(0.0)****	0.1132	(0.0)****
ASP							
Coefficient	22.262	0.1310	0.0881	0.0751	0.105016	0.023521	0.070627
t-sta	− 1.4524	3.1112	0.1559	− 1.732	4.241036	0.560186	3.852978
p-val	(0.147)	(0.002)***	(0.876)	(0.084)*	(0.0)****	0.5755	(0.0)****

\*\*\*\*, \*\*\*, \*\* and \* denote statistical significance at the 0.1%, 1%, 5%, and 10% significance level, respectively. The table contains z-statistic and their corresponding p-values below in brackets

**Table 6** Correlated panel corrected standard error regression results

<b>Top quartile of Human Development Index</b>				
	<b>GEI</b>	<b>ATT</b>	<b>ABT</b>	<b>ASP</b>
Constant	87.12502	69.07159	76.56989	118.8824
<i>t</i> -sta	1.43	1.08	1.14	2.08
<i>p</i> -val	(0.152)	(0.280)	(0.253)	(0.038)**
IVAR1	0.1873287	0.2623537	0.2421315	0.0484742
<i>t</i> -sta	0.43	0.55	0.48	0.10
<i>p</i> -val	(0.668)	(0.584)	(0.628)	(0.922)
IVAR2	0.0687848	− 0.0937154	0.1468298	0.1701754
<i>t</i> -sta	0.58	− 0.59	1.33	1.20
<i>p</i> -val	(0.560)	(0.554)	(0.184)	(0.231)
IVAR3	− 1.143517	− 1.098328	− 1.083762	− 1.31312
<i>t</i> -sta	− 2.41	− 2.52	− 2.27	− 2.37
<i>p</i> -val	(0.016)**	(0.012)**	(0.023)**	(0.018)**
IVAR4	0.0245317	0.1683423	− 0.0064358	− 0.0870715
<i>t</i> -sta	0.07	0.41	− 0.01	− 0.23
<i>p</i> -val	(0.941)	(0.684)	(0.988)	(0.817)
IVAR5	0.2238076	0.1905711	0.2838033	0.1902578
<i>t</i> -sta	1.72	1.24	2.34	1.04
<i>p</i> -val	(0.086)*	(0.215)	(0.019)**	(0.300)
IVAR6	0.3483261	0.4218057	0.2582443	0.3526852
<i>t</i> -sta	3.05	3.84	1.75	2.31
<i>p</i> -val	(0.002)***	(0.0)****	(0.080)*	(0.021)**

Included countries: Norway, Switzerland, Ireland, Germany, Iceland, Sweden, Australia, Hong Kong (China, SAR), Netherlands, Denmark, Finland, Singapore, United Kingdom, Belgium, United States, Austria, Israel, Japan, Republic of Korea, Slovenia, Spain, France, Czechia, Italy, Estonia, Greece, Cyprus, United Arab Emirates, Lithuania, and Poland

<b>Bottom quartile of Human Development Index</b>				
	<b>GEI</b>	<b>ATT</b>	<b>ABT</b>	<b>ASP</b>
Constant	− 8.891795	− 13.72212	− 7.255755	2.04772
<i>t</i> -sta	− 0.77	− 1.10	2.14	0.18
<i>p</i> -val	(0.438)	(0.270)	(0.032)**	(0.854)
IVAR1	0.1297192	0.1251712	0.1342337	0.1296719
<i>t</i> -sta	2.07	1.65	2.14	1.84
<i>p</i> -val	(0.039)**	(0.099)*	(0.032)**	(0.065)*
IVAR2	− 0.0449595	− 0.0214193	− 0.0436452	− 0.0817002
<i>t</i> -sta	− 0.37	− 0.13	− 0.52	− 0.90
<i>p</i> -val	(0.708)	(0.893)	(0.606)	(0.370)
IVAR3	0.0747578	0.1309323	0.0378115	− 0.038533
<i>t</i> -sta	0.66	1.00	0.30	− 0.34
<i>p</i> -val	(0.509)	(0.318)	(0.763)	(0.735)
IVAR4	0.2516691	0.1502157	0.3186227	0.2786484
<i>t</i> -sta	2.56	1.24	3.00	3.18
<i>p</i> -val	(0.010)**	(0.213)	(0.003)***	(0.001)***
IVAR5	− 0.0315787	0.0547889	− 0.0553894	− 0.0993579
<i>t</i> -sta	− 0.48	0.74	− 0.72	− 1.46
<i>p</i> -val	(0.630)	(0.459)	(0.474)	(0.143)
IVAR6	0.1079288	0.1427088	0.1017216	0.1125428
<i>t</i> -sta	1.70	3.21	1.33	2.69
<i>p</i> -val	(0.089)*	(0.001)***	(0.183)	(0.007)***

Included countries: Chad, Mozambique, Burkina Faso, Sierra Leone, Mali, Burundi, Liberia, Ethiopia, Malawi, Senegal, Mauritania, Benin, Uganda, Rwanda, Nigeria, Côte d'Ivoire, United Republic of Tanzania, Madagascar, Cameroon, Pakistan, Angola, Zambia, Kenya, Ghana, Namibia, India, Honduras, Bangladesh, and Nicaragua

**Table 6** (continued)

\*\*\*\*, \*\*\*, \*\*, and \* denote statistical significance at the 0.1%, 1%, 5%, and 10% significance level, respectively. The table contains z-statistic and their corresponding *p*-values below in brackets

recovery rate; and the number of procedures, time, and cost of getting electric utility service. Our results are partially consistent with Stel et al. (2007), who study a sample of 39 countries from 2000–2005 using GEDI's GEI data and find that the minimum capital requirement for business startups has a negative impact on entrepreneurial activities. However, our results contrast with theirs since they find that bureaucratic requirements such as the time, cost, or the number of procedures required to launch a business have no significant relationship with the creation rate of either nascent or young enterprises. Similarly, our findings are consistent with the OECD (2004), which informs about significant evidence regarding the adverse impact of excessive regulatory and administrative burdens on the national entrepreneurial activity. They recommend minimizing regulatory and administrative burdens and improving structural policies that determine the national economic framework, particularly those affecting financial markets and bankruptcy laws.

Our results also show a significant effect of the financial freedom index on the GEI and its sub-indexes. The financial freedom index is a metric of domestic banking efficiency and measures government interference in the banking and financing industry sector. The index also reflects the central bank's independence and the degree of foreign financial institutions' freedom to operate domestically. Our results oppose those of Ho and Wong (2007), who study a sample of 37 countries using 2002 GEM data and find that the availability of informal investors has a positive impact on the entrepreneurial activity while the availability of institutional VC investors and debt financing has no significant effect on both NDE and ODE.

The ATT sub-index measures the population's perceptions of entrepreneurial business opportunities by evaluating the state of property rights and the national regulatory burden for entrepreneurial activity. This sub-index also evaluates the population's perception about their startup skills acquired through formal education or experience. This sub-index additionally considers the population's perception of entrepreneurial risk, defined as the fear of business failure. This sub-index also includes the degree of entrepreneurial networking and the entrepreneurial cultural support defined as the social status associated with the entrepreneurial activity. Our results support Petrakis and Kostis (2014), who find that the cultural trait component of entrepreneurial promotion has a positive influence on ODE. They also find that local economic institutions and transactions characterized by low business risk, short business time formation, low corruption, the rule of law enforcement, and property rights protection are beneficial to ODE.

Our results suggest that countries with low business freedom indexes characterized by long, delayed, and expensive procedures for business startups, license acquisitions, and power service applications have a negative and significant impact on the ATT sub-index's components listed above. Inferior business freedom indexes are usually common in low-income countries with high self-unemployment rates, high levels of NDE, and inadequate entrepreneurial activity's social status. Similarly, countries with

low financial freedom indexes suffer from low banking efficiency, which reduces the entrepreneurs' funding opportunities. These entrepreneurs can significantly reduce their fears of business failure by having the financial support of an institution willing to fund their business endeavors. Similarly, necessity entrepreneurs in low-income countries will face many challenges when trying to get financial support from their domestic formal lending sector due to the devaluated social status of their entrepreneurial activities. Our interpretation is consistent with Eton et al. (2021), who find that financial inclusion is a critical success factor for SME growth in Uganda. They also find challenges for financial users to access financial services and characterize the attention from financial providers as disrespectful and undignified.

The ABT sub-index includes the opportunity motivation measured by the percentage of NDE of a country's total entrepreneurial activity. Opportunity entrepreneurs are considered to have skills and knowledge better than those of necessity entrepreneurs. The ABT sub-index also comprises the information and communication technology absorption and diffusion at the firm level and the availability of high-quality human capital, including the entrepreneur's level of education. The ABT sub-index also considers the business competition level in domestic markets and the efficacy of domestic anti-monopoly regulations. Our results suggest that an entrepreneurial ecosystem characterized by low business freedom indexes will discourage well-educated and skillful opportunity entrepreneurs, reducing the level of domestic business competition and encouraging monopolistic practices characteristic of economies with bureaucratic government institutions. Similarly, our results suggest that entrepreneurial ecosystems with inefficient banking and financial industry sector will reduce the funding opportunities for entrepreneurs who may prefer to exchange their superior skills and knowledge for the income stability of traditional well-paid jobs.

The ATT sub-index includes the product innovation pillar, defined as a country's capacity to create new products and adopt or imitate existing ones through technology transfer enabled by a business environment that fosters innovation. The ATT sub-index also considers the process innovation pillar, defined as the combination of R&D expenditures as a percentage of GDP, quality of national scientific institutions, and the domestic availability of scientists and engineers. The ATT sub-index additionally encompasses the high growth pillar, which is a combined measure of the percentage of high-growth businesses, the level of business strategy sophistication, and the availability of VC financing. The ATT sub-index also covers the pillar of internationalization, which is a composite of a country's exports, openness to international entrepreneurs, and economic complexity measured by the mix of locally made products. Lastly, the ATT sub-index comprises the risk capital pillar composed of the national informal equity investment and the institutional depth of the domestic capital market measured by a combination of factors including the magnitude and liquidity of a country's stock market, intensity of domestic initial public offerings, mergers and acquisitions, and the local debt and credit market activity.

Our results suggest that entrepreneurial ecosystems with superior business freedom indexes will boost the national R&D capital investment leveraged by high-quality local scientific institutions with an adequate supply of domestic scientists and engineers. Similarly, these countries with superior business freedom will attract VC investors willing to

invest in the plethora of investment alternatives available in a highly complex economy with various locally made products and services offered by a dynamic national entrepreneurship activity. Our results' interpretation supports Kim and Lee (2022), who find that VCs facing low uncertainty focus on entrepreneurs' education background for investment decision, while entrepreneurial managerial experience is emphasized when dealing with high uncertainty on investment decisions.

Likewise, our results suggest that an entrepreneurial ecosystem characterized by low business financial indexes cannot provide the financial support needed by high-growth businesses. Correspondingly, entrepreneurial ecosystems with inefficient banking and financing industry sector are incompatible with VC investors' willingness to invest in startups. Equally, a lack of backing and financial efficiency can harm a country's exports and openness to international entrepreneurs.

Our results provide partial evidence of a significant relationship between the trade freedom index and the GEI and its sub-indexes. The index's calculation encompasses a weighted average tariff rate and a qualitative evaluation of nontariff restrictions. These nontariff limitations include qualitative restrictions (e.g., import quotas, countertrade, import–export bans, etc.), regulatory restrictions (e.g., domestic content requirements, safety, and sanitary standards, etc.), customs restrictions (e.g., custom procedures on valuation, classification, clearance, etc.), and direct government intervention (e.g., subsidies, competition policies, government monopolies, etc.) Opportunity entrepreneurs thrive in an entrepreneurial ecosystem open to free trade of goods and services. Open economies have high levels of business competition and high levels of firms' information and communication technology absorption and diffusion. This view is consistent with Hanna (2018), who suggests that government programs aimed at promoting a SME digital transformation should address information and communication technology infrastructure and institutional-related issues.

In countries with high trade freedom, skillful and knowledgeable opportunity entrepreneurs can command high-growth business endeavors based on sophisticated business strategies like economies of scale that can be achieved through the export of goods and services. Closed economies with low trade freedom will struggle to attract international entrepreneurs. These economies are usually characterized by shallow national capital markets with low liquidity and infrequent initial public offerings. Our results support the view of Ács et al., (2008a, 2008b), who suggest that countries can foster entrepreneurship by stimulating outward foreign direct investment and international trade. Similarly, our interpretation is consistent with Momeni et al. (2019), who conclude that the reinforcement of institutional framework and knowledge-based innovation contributes to developing a knowledge-based economy.

Our lack of a significant relationship between GEI and its sub-indexes with the labor, fiscal, and monetary freedoms indexes contrast with the significant results of McMullen et al. (2008), Diaz-Casero et al. (2012), and Stel et al. (2007) quoted previously. Our results partially support those of Nyström (2008) regarding the positive relationship between self-employment and inferior regulatory framework for credit and businesses. However, Nyström's (2008) self-employment does not differentiate between ODE and NDE as we do in our article. Similarly, our results partially contradict those of Ghosh and Hall (2018) regarding the negative relationship between trade freedom

and entrepreneurial orientation. Correspondingly, our results partially agree with Erkut (2016) regarding the positive entrepreneurial impact of effective bureaucracy and entrepreneurial government support. Our results also partially support those of Herrera-Echeverri et al. (2014), regarding the positive relationship between institutional quality and the rate of business creation. Likewise, our results contradict Ridderstedt (2014) regarding the lack of a significant relationship between economic freedom and entrepreneurship.

Our results comparing HDI averages' top and bottom quartiles suggest that monetary and investment freedoms are significant factors for ODE but not for NDE. The HF calculates the monetary freedom using a mixture of the 3-year weighted average rate of inflation and a qualitative assessment of the government interference of free market-based prices through government controls and subsidies. Countries with high HDI can enjoy superior monetary freedom characterized by low inflation rates and low levels of government interference through price controls in the domestic market and lack of subsidies in most industry sectors. Surprisingly, the presumed predominant ODE in these countries is negatively impacted by a lack of inflation and government intervention. Contrarily, when government price controls and subsidies are implemented to curb inflation, ODE seems to thrive better under such conditions. One possible interpretation would be that ODE in high HDI countries may benefit from price controls and subsidies to protect sensitive industry sectors with significant influence and representation in national political processes. For example, agricultural business activities have been heavily subsidized in most developed economies for strategic and political considerations.

HF determines the investment freedom based on a utopic scenario of people and companies allowed to allocate their resources in and out of economic activities, both nationally and internationally, without any government constraints. Index points are subtracted for every identified restriction related to the national approach to foreign investments and its regulatory framework, controls on land ownership and sectorial investment, asset expropriations without reasonable compensation, foreign exchange, and capital controls. When countries with high HDI exhibit low investment freedom, the government imposes various investment capital controls. These controls include but are not limited to restrictions on payments, transfers, capital transactions, and access to foreign exchange. This excessive regulatory burden negatively impacts the ODE's ATT sub-index, increasing the perceived entrepreneurial risk of business failure.

Similarly, these investment capital controls will reduce the ODE's ABT sub-index by reducing the information and communication technology absorption and diffusion at the firm level and the domestic competition. Lastly, these controls will decrease the ODE's ATT sub-index by reducing the technology transfer and R&D expenditures, adversely affecting domestic high-growth businesses and driving away VC investors. These countries will also reduce their attractiveness to international entrepreneurs and decrease their national economic complexity measured by the mix of locally made products. Lastly, these controls will reduce the liquidity of national stock markets and the local mergers and acquisitions, initial public offerings, and credit market activities. Our results are consistent with Nikolaev et al. (2018), who study the impact of 44 NDE and ODE determinant factors in a sample of 73 countries. They find that economic freedom has the most significant explanatory power on both NDE and ODE across nations.



Notably, they find that countries enjoying robust business and investment freedoms have associated a robust entrepreneurial activity.

Similarly, our results contrasting ODE and NDE show that those freedom-related factors (business, financial, and trade freedom indexes) with significant impact in our total sample of 118 countries are the same as those significantly affecting those countries at the bottom HDI quartile representing the NDE. This similarity these results may be interpreted assuming that NDE is the dominant force in our total sample and, as a result, it displays the same significant relationships identified among low HDI countries.

Our significant results on the relationship between business freedom and the GEI and its sub-indexes for NDE predominant countries contrast with our insignificant results on the relationship between these same variables for NDE prevalent countries. On the one hand, these results are precisely the opposite of Ho and Wong (2007), who find that regulatory business costs have a negative and significant effect on ODE but an insignificant one on NDE. On the other hand, our results are consistent with Ács et al. (2008b), who study a sample of 40 countries from 2003–2005 using GEM and World Bank Entrepreneurship Snapshot data and find that entrepreneurs in developing countries are willing to formalize their business ventures when the entry barriers are low. Therefore, the significant impact of the business freedom on the GEI and its sub-indexes in countries with low HDI may be interpreted by the fact that ODE usually operates in economic sectors characterized by high entry barriers while NDE thrives in business sectors with low entry barriers. Another possible interpretation suggested by Ács et al. (2008b) is that companies in developed nations have incentives to incorporate and receive the associated benefits like superior access to formal funding sources and labor contracts.

Our significant results on the relationship between financial freedom and the GEI and its sub-indexes for ODE and NDE predominant countries contradict those of Boudreaux and Nikolaev (2019), assuming that the HDI is a reasonable proxy to measure a country's quality of the institutional environment. They study the relationship between human, social, and financial capital with the ODE using Fraser Institute's IEF and GEM data from a sample of 47 countries. They find that financial capitals have a strong explanatory power on entrepreneurship in nations with inferior quality of institutional environments, but that strength decreases as the institutional environment quality improves.

The limitations of our study include the diversity of national entrepreneurial ecosystems and the difficulty of measuring them with a few quantitative variables. The GEI of a country represents a wide variety of industry sectors spanning food and restaurants, agriculture, retail industry, travel and tourism, health, cosmetics, fitness, computers, software, etc. There are significant differences among these sectors regarding entrepreneurial attitudes, abilities, and aspirations. Another limitation is that our results can be significantly different depending on the selected countries for analysis purposes (e.g., NDE vs. ODE).

## Conclusions

Our article analyzes the entrepreneurial impact of public policies determining some constituent factors of economic freedom among different countries worldwide. We study historical data of a sample of 118 countries from 2014–2019 using the GEDI's GEI and its sub-indexes as dependent variables. We also use some constituent

components of the Heritage Foundation's IEF as our independent variables. We find a significant and positive relationship between the GEI, including all its sub-indexes (ATT, ABT, and ASP), and the business and financial freedom indexes for worldwide countries. We also find significant partial results of a positive relationship between the trade freedom index and the GEI and its ABT and ASP sub-indexes. Regarding the sub-sample of countries representing ODE versus NDE, we find that countries with ODE predominance show a negative and significant relationship between the GEI, including all its sub-indexes (ATT, ABT, and ASP) and the monetary freedom. Similarly, our results show a positive and significant relationship between the investment freedom index and the GEI and its ABT sub-index. We also find that countries with NDE prevalence have a positive and significant relationship between the GEI, including all its sub-indexes (ATT, ABT, and ASP) and the business freedom index, the trade freedom index excluding the ATT sub-index, and the financial freedom index excluding the ABT sub-index.

Our results can help to explain why some countries experience a dynamic national entrepreneurial activity that fosters economic growth while others stagnate. In a global context, our results suggest that an optimal local business environment and financial institutions, liberal foreign trade policies, market-driven economies with low government interference, and open investment markets can explain a vibrant domestic entrepreneurial activity. Our results may be valuable for government decision-makers, especially top policymakers who need to support their decision-making processes on scientific data and analysis. Our results may also help government authorities to adjust existing strategies and policies to improve one or more of the analyzed IEF's constituent factors.

#### Abbreviations

ABT	Entrepreneurial abilities
ASP	Entrepreneurial aspirations
ATT	Entrepreneurial attitudes
GEDI	Global Entrepreneurship and Development Institute
GEM	Global Entrepreneurship Monitor
HDI	Human Development Index
IEF	Index of Economic Freedom
NDE	Necessity-driven entrepreneurship
ODE	Opportunity-driven entrepreneurship
SMEs	Small and medium-sized enterprises
UN	United Nations
VC	Venture Capital

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#### Availability of data and materials

All data supporting our article's results are publicly available in the sources adequately cited in Sect. 2. METHODS with the relevant hyperlinks included in Sect. 6. REFERENCES.

#### Declarations

##### Competing interests

The authors declare that they have no competing interests.

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