A G D I Working Paper

WP/21/096

Historical Prevalence of Infectious Diseases and Entrepreneurship: the Role of Institutions in 125 Countries

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2021 African Governance and Development Institute WP/21/096

Research Department

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September 2021

Abstract

This study examines the effects of the historical prevalence of infectious diseases on contemporary entrepreneurship. Previous studies reveal the persistence of the effects of historical diseases on innovation, through the channel of culture. Drawing on the epidemiological origin of institutions, we propose a framework which argues that the impact of infectious disease prevalence on contemporary entrepreneurship is mediated by property rights. The central hypothesis posits that a guarantee of property rights reduces the effect of past diseases on entrepreneurship. Using data from 125 countries, we find strong and robust evidence on the proposed hypothesis and other results. Property rights are higher in countries where the prevalence of diseases was low, which leads to good entrepreneurship scores. In contrast, countries with high disease prevalence did not have time to develop strong institutions to secure property rights. This explains their low level of entrepreneurship today. These results are robust to alternative methods and measures of property rights. Furthermore, our results also confirm the level of development, culture and the digitalization of economies as transmission channels between past diseases and the current level of entrepreneurship.

Keywords: entrepreneurship; institutions; diseases; property rights

JEL Classification: I0, J24, I21, I31

1. Introduction

Entrepreneurship is very important for the dynamics of economies around the world. The aspiration, ability and capacity to develop entrepreneurship are very important for economic growth. Unfortunately, the 2019 Global Entrepreneurship report highlights that there are still significant gaps between countries. While entrepreneurship is important for all countries, its explanatory factors vary quite widely. The literature on the determinants of entrepreneurship has focused on foreign direct investment inflows; unemployment; trade freedoms; political regime; and institutional quality (e.g. Dvouletý, 2018; Draghici & Albulescu, 2014; Tunali & Sener, 2019; Maâlej, 2013; Tchamyou, 2017; Asongu & Nwachukwu, 2018; Chowdhury & Audretsch, 2018). In a parallel literature, it has been shown that the epidemiological past affects the current level of development through the channel of institutional quality (Alsan et al., 2015; Acemoglu et al., 2003a; Sokoloff & Engerman, 2000; Asongu & Odhiambo, 2019; Diamond, 1997). Thus, it appears that the historical prevalence of infectious diseases may affect entrepreneurship through the institutional channel. Our hypothesis is that good property rights (institutional) protection in a country reduces the effect of the historical prevalence of infectious diseases on the level of entrepreneurship. To our knowledge, no study has attempted to conduct an interdependence analysis between historical disease prevalence, institutions and entrepreneurship levels.

We propose that historical high prevalence of infectious diseases in a country forced people to move to other localities. This prevented them from carrying out agricultural activities, from organizing themselves better and from having a sedentary and powerful political power able to guarantee property rights. This justifies their low level of entrepreneurship today. On the other hand, in countries with a low historical prevalence of infectious diseases, the populations had the opportunity to develop agricultural activities, to set up a formal organization capable of guaranteeing property rights and even effective cooperation with the outside world. This justifies their good entrepreneurial performance today (Sachs, 2003; Olsson & Hibbs, 2005).

In the light of the above, the objective of this paper is to analyze the effect of historical disease prevalence on entrepreneurship by considering institutions (property rights). Drawing on the epidemiological origin of institutions, we propose a framework suggesting that the impact of the historical prevalence of infectious diseases on contemporary entrepreneurship is mediated by property rights. The central hypothesis posits that a guarantee of property rights reduces the effect of past diseases on entrepreneurship. Using data from 125 countries, we find strong and robust evidence on the proposed hypothesis and other results. Property rights are higher in

countries where the prevalence of diseases was low, which leads to good entrepreneurship scores. In contrast, countries with high disease prevalence did not have time to develop strong institutions to secure property rights. This explains their low level of entrepreneurship today. These results are robust to another method of estimation and to alternative measures of property rights. Furthermore, our results also confirm the level of development, culture and digitization of economies as transmission channels between past diseases and the current level of entrepreneurship. The interest of this study lies at several levels.

First, we contribute to the literature on the causes of entrepreneurship by suggesting that cross-country differences in entrepreneurial outcomes such as skills, aspirations, and entrepreneurial capacity have their root origins in the historical prevalence of disease, which in the present study, is an exogenous environmental factor (Faulkner et al., 2004; Park et al., 2007). Specifically, we combine the value theory of parasitic stress with the literature on deep-rooted factors of development. This leads us to identify countries with low entrepreneurial capacity that have a history of high prevalence of infectious diseases; countries with good entrepreneurial performance that have low historical disease prevalence. Second, we explore the extent to which the relationship between past pathogenic stress and contemporary entrepreneurship is determined by the quality of institutions that secure property rights. Finally, beyond the focus on institutions, we also identify other transmission channels that can be seen to mediate the relationship between the historical prevalence of infectious diseases and contemporary entrepreneurship. The remainder of the paper presents the literature review in section 2. Section 3 provides a descriptive analysis of the data and specifies the methodology. Sections 4 and 5 present the results and sensitivity tests and section 6 concludes.

2. Literature review

2.1 Conceptual foundations on the epidemiological origin of entrepreneurship

The epidemiological underpinnings of entrepreneurship are entrenched in the literature on deep-rooted factors of development. This literature incorporates the historical importance of the hostile (versus hospitable) environment in the analysis of developmental differences between countries. A distinction is then made between countries with a harsh ecological environment and countries with a hospitable ecological environment. One factor of environmental hostility is the prevalence of human-related epidemics (Gallup et al., 1999; Sachs & Malaney, 2002; Sachs, 2003). According to the latter, a highly epidemic locality prevents people from undertaking agricultural activities and is forced to a lack of settlement. In such a context it becomes difficult

for these localities to carry out persistent water drainage (Lande, 1998) and infrastructure development (Gallup et al., 1999). Alsan (2015) for example demonstrates empirically that Africa's economic backwardness has its origins in the prevalence of tsé-tsé fly which has favored the development of sleeping sickness. It then distinguishes African countries with a high prevalence of sleeping sickness caused by tsé-tsé fly bites from other countries on the same continent that have not experienced this epidemic. The latter studies show that countries historically affected by tsé-tsé fly have had difficulty establishing good institutions and consequently have poor economic performance.

2.2 Institutional quality and historical disease prevalence

The influence of the epidemiological past on the institutional framework allows us to distinguish between two categories of community presented by the new history literature (Papaioannou & Michalopoulos, 2017). These are the communities with highly centralized political institutions of the communities without a well-established institutional organization. The first communities belonged to geographical areas less exposed to epidemics. This context favored the sedentary lifestyle of the populations and led to the establishment of a fairly powerful political organization that persisted over time. This made it possible to define the channels of cooperation with the outside world and the security of resident properties. On the other hand, communities with an epidemic environment were in most cases forced to move, especially when the latter depended on hunting and gathering. It was therefore difficult for such a community to organize itself better. In general, these communities were characterized by weak centralization of political institutions not capable of ensuring the security of people and goods as well as property rights. Indeed, the difficulty of Africans in the past to build states and the extension of a protective authority has its origins in the low population density and transportation costs (Herbst, 2000). For Aslan (2015), these factors were fostered by an epidemiological environment. His analysis on Africa is consistent with the work of Michalopoulos andPapaioannou, (2013). The latter documents that the strong political centralization of pre-colonial institutions is an explanatory factor for the difference in institutional quality between countries. Indeed, the level of centralization of pre-colonial institutions correlates with the development of modern Africa (Gennaioli & Rainer, 2007; Michalopoulos & Papaioannou, 2014).

2.3 Theory and hypothesis development: disease pathogens and entrepreneurship

The historical prevalence of infectious diseases is an important determinant of entrepreneurship. Fincher et al. (2013) demonstrate that people who lived in areas with low levels of parasites were less likely to be at risk of infectious disease. Thus, these people tended to engage in economic and social interactions that ensured benefits with individuals belonging to out-groups. The underlying is because the potential cost of contagion was lower than the cost of exchange (Bennett & Nikolaev, 2021). The exchanges made here by the different communities favored the sharing of experience necessary for entrepreneurship. Moreover, as the size of the market increases, there is generally a specialization and a division of labor. This is favorable for innovation and entrepreneurship. According to Smith (2008) this context also favors innovation and develops the spirit of entrepreneurship. We then witness the development of a virtuous cycle of attitudes, aspirations and capacities to undertake, driven here by the improvement of productivity, the reduction of production costs and the improvement of the quality of goods and services available. Cooperation between people encourages innovative ideas; the development of infrastructure and even innovation-friendly intuitions (North, 1991; Audretsch & Keilbach, 2007; Woolley, 2014; Audretsch et al., 2015; Bennett, 2019). There is also the diffusion of new knowledge which in reality should facilitate entrepreneurship. On the other hand, people who live in regions where there are more parasites avoid economic and social interactions with the outside world simply to avoid possible contamination. This limits mutually beneficial exchanges. Liebowitz and Margolis(1995) specify moreover that individuals living in areas with a high prevalence of infectious diseases have often been less exposed to innovations caused by external evolution. This behavior persists over time and results in less innovative and less entrepreneurial countries today. The comparison of Figure 1 and Figure 3 clearly shows that the geographical distribution of the high prevalence of infectious diseases is in Africa and South America. On the other hand, these countries also have low scores in entrepreneurship. This leads us to propose the first hypothesis:

> ***Hypothesis 1:*** *Countries with higher historical disease prevalence are less entrepreneurial today.*

2.4Institution and entrepreneurship

According to North (1991), Third World countries are poor because the institutional constraints that should frame economic policy do not encourage productive activity and entrepreneurship. These countries are often characterized by extractive (versus inclusive) institutions that do not

encourage economic activity (Acemoglu et al., 2001). Indeed, in comparative development analysis, the quality of institutions depends on the type of settlement. The localities hostile to the development of the colonists were inherited institutions that had to protect only the advantages of the colonial power to the detriment of the colony. This sometimes left a low level of entrepreneurship. This was the case in Africa. On the other hand, localities with hospitable advantages led the colonists to install inclusive institutions that favored local development and the emergence of a local elite. Acemoglu et al. (2012) revisited this theory by empirically showing that the protection of property rights is historically based and depends on the divide between inclusive and extractive institutions. This further establishes the importance of history on the origins of institutions. Using Argentina and Ghana as case studies, Acemoglu et al. (2003) show that, policy distortions are not the real determinants of poor economic performance. Indeed, the latter are nothing but a symptom of historical facts related here to the type of colonization. It is also shown that institutional environments create appealing individual decision making conditions, which are relevant in entrepreneurial cognition and the quality of entrepreneurship (Maâlej, 2013). The institutional setting surrounding the performance of an activity often determines whether that activity is productive, destructive or unproductive. Thus, the quality and quantity of entrepreneurial activity improves when institutional reforms change the environment in which decisions are made and implemented. The study of Baumol(1990) on the legal and policy environment determines the willingness of entrepreneurs to exploit or commercialize different opportunities. The analysis of geographical distributions presented in Figure 1 and Figure 2 clearly shows that countries with poor property rights scores also have poor entrepreneurship scores. This theoretical and factual background leads us to the following second hypothesis:

> ***Hypothesis 2****: Countries with good quality of institutions (protection of property rights) are much more entrepreneurial.*

2.5Disease prevalence, institutions and entrepreneurship

The interrelationship between disease prevalence, institutions and entrepreneurship can first be established by the parasitic stress theory of cultural[1] values. Indeed, the prevalence of disease

[1] According to Bennett and Nikolaevv(2021, p. 3)"*theparasitic stress theory of cultural values describes an evolutionary process linking the historical prevalence of disease in a region to the development of individualistic/collectivistic cultural attitudes, beliefs and values. Humans have adapted to defend themselves against infectious diseases, a major source of morbidity and mortality, in two main ways: (1) adaptations of the classical (physiological) immune system (e.g., biochemical, cellular and tissue systems) and (2) adaptations of the behavioral (psychological) immune system. A growing body of evolutionary biology and psychology literature provides evidence that adaptations of the psychological immune system, which consist of "adaptive ancestral*

shapes cultures which in turn influences institutions and in turn explains the differences in entrepreneurial performance between countries. This theory presents an evolutionary process in which human distrust of the risk of epidemic contagion leads to the establishment of a number of cultural values. For example, Navarrete et al. (2007) state that if people perceive that they are exposed to pathogens, they are more likely to exhibit behaviours associated with ethnocentrism. Faulkner et al. (2004) note the high prevalence of xenophobia and, more generally, the avoidance of others as detailed in the work of Mortensen et al. (2010). In other words, a threat of contagion, forces people to be less agreeable, less open to new experiences and more introverted. Cashdan and Steele (2013) associate the advocating of collectivist values to children by parents with parasitic stress. Thus, high prevalence of pathogenic stress significantly explains in-group conformity and favoritism (Murray et al., 2011; Fincher et al., 2013). In contrast, in the absence of epidemics, people tend to cooperate. This explains the empirical divide between individualistic versus collectivistic cultures. The former are more conducive to innovation and entrepreneurship while the latter do not participate in the good outcome(Alesina & Giuliano, 2010; Thornhill & Fincher, 2014). Nikolaev et al. (2017) furthermore demonstrate that the historical prevalence of diseases has shaped the quality of property rights and commercial freedoms.

Then, the second part of the relationship is on the interactions between culture and institutions (Acemoglu & Robinson, 2021; Hodgson, 2021; Guiso et al., 2015; Owes et al., 2017; Spranz et al., 2012; Peralta & Georgia, 2013). These two variables persist over time on development and entrepreneurship. Especially since the new economic history literature empirically demonstrates the persistence of epidemiological past on development through the channel of institutions (Michalopoulos & Papaioannou, 2013; Alsan et al., 2015). The cross analysis of Figures 1, 2 and 3 shows us that countries with high disease prevalence are characterized by poor institutions (property rights) and also have poor entrepreneurship scores. This finding leads us to formulate the following third hypothesis:

> ***Hypothesis 3:*** *The quality of institutions influences the relationship between historical disease prevalence and entrepreneurship, such that low disease prevalence leads to protection of property rights, which in turn encourages high entrepreneurship scores.*

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feelings, attitudes, and values about, and behaviors toward, outgroup and ingroup members, have played an important role in the natural selection of cultural values in human evolutionary history".

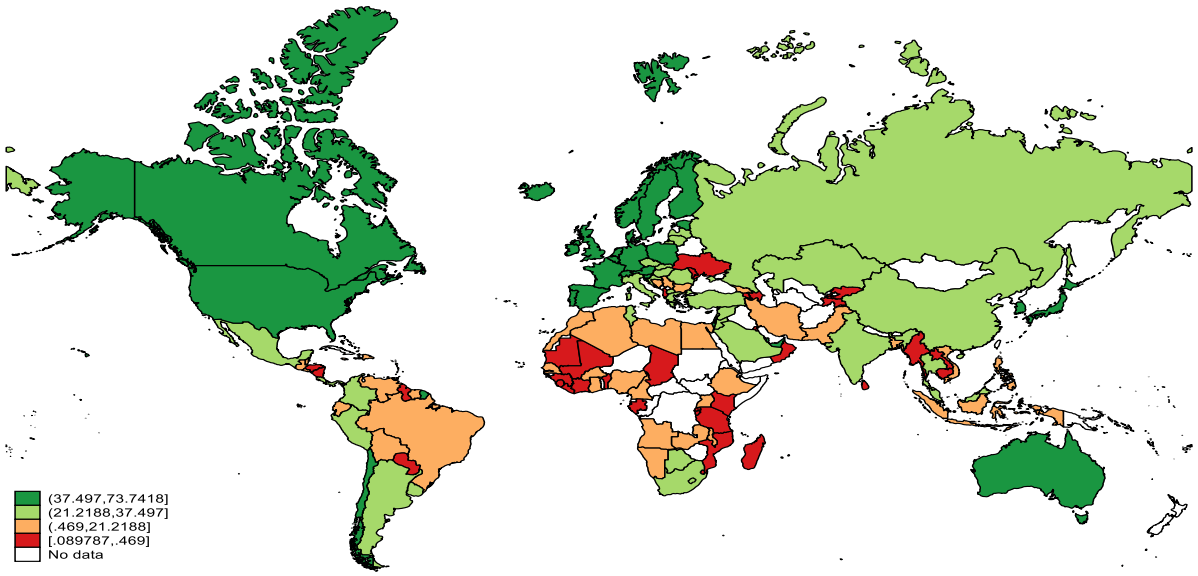
3. Data and methodology

3.1Data

3.1.1. The entrepreneurship index

To measure entrepreneurship, we chose the index of "The Global Entrepreneurship and Development Institute" proposed by Lafuente et al. (2019) . It ranges from 0 (no entrepreneurship) to 100 (high entrepreneurship capacity). This index combines entrepreneurial attitudes, capabilities and aspirations in each country. It measures the proportion of people who have the vision of an innovation and the ability to bring it to market for each country in our sample. The calculation of this variable was made possible by collecting 14 pillars of information necessary for entrepreneurship. These are: Opportunity Perception, Risk Acceptance, Startup Skills, Networking, Cultural Support, Technology Absorption, Opportunity Startup, Human Capital, Product Innovation, Competition, Process Innovation, Internationalization, High Growth, and Venture Capital. This index has already been used in several empirical works (Cacciotti et al., 2016; Bennett, 2018; Bennett, 2019; Bylund & Mccaffrey, 2017). In summary this index measures both the quality of entrepreneurship in a country and the breadth and depth of the entrepreneurial ecosystem that supports it (Chowdhury & Audretsch, 2018). The map below shows the geographical distribution of entrepreneurship across the world.

Figure 1: Distribution of entrepreneurship around the world

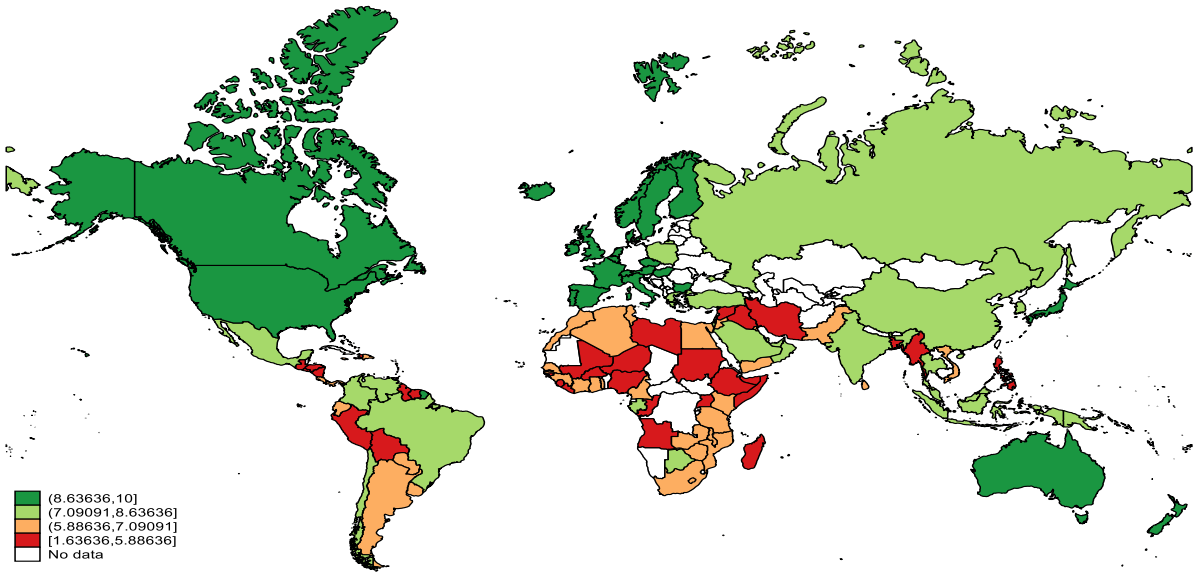


***Source**: Authors' construction based on data from the Global Entrepreneurship Index; low levels of entrepreneurship are concentrated in Africa and some South American countries.*

3.1.2 Institutions (property rights)

The institution variable draws its theoretical foundation from the work on the new economic history, which allows us here to highlight the deeply rooted factors of contemporary development (Acemoglu et al., 2001; Chanda & Putterman, 2002; Alsan et al., 2015; Margo, 2018; Xu, 2019; Vu, 2021; Nunn, 2020; Giuliano & Nunn, 2018; Ang & Fredriksson, 2021; Bhattacharya, 2017). We use the institutional variable "average protection against Expropriation Risk" from the work of Acemoglu et al. (2001). This variable measures the level of protection of investors' property rights. It varies between 0 (no protection of investors' property rights) and 10 (strong protection of investors' property rights). It is a variable that has made it possible to highlight the importance of historical shocks such as colonization on the quality of institutions. In the sense of Acemoglu et al. (2001), the development gaps between countries are the result of the dialectic between inclusive versus extractive institutions imposed by the types of colonization. In order to take into account, the past period (from 1995 to 2021) we used two other alternative measures of institutions related to our variable. These are "Security of property rights" and "Security of private contracts" proposed by the "Institutional Profiles Database 2016 version" under the coordination of the French Treasury (Bertho, 2013). Figure 2 below presents the distribution of property rights around the world.

Figure 2: Distribution of property rights protection around the world

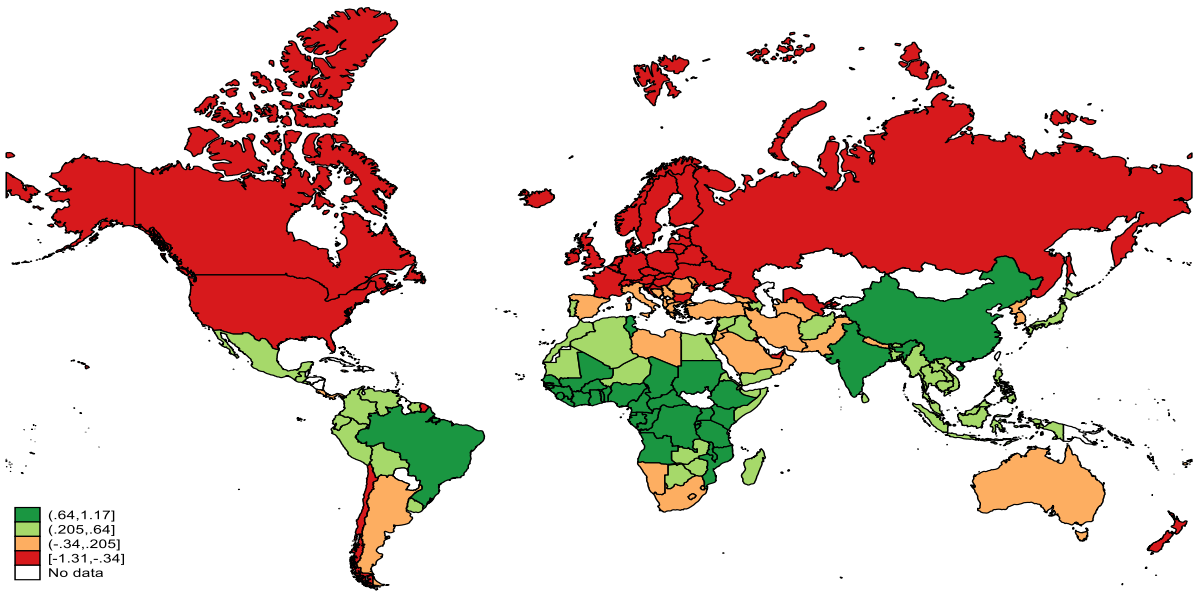


***Source**: Authors' construction based on Acemoglu et al (2001); African and South American countries have the worst scores.*

3.1.3. Historical prevalence of infectious diseases

The variable "***historical prevalence of infectious diseases"*** is chosen under the inspiration of the vast cross-cultural literature developed by many authors such as Bennett and Nikolaev (2021), Bennett (2019), Bennett (2018), Nikolaev et al. (2017) and Fincher et al. (2013). The index used is that of Murray and Schaller (2010). This index assesses the intensity of historical disease prevalence for over 150 countries. The calculation of this index is based on the severity of nine diseases dangerous to human survival and reproductive health. These include: dengue, trypanosomes, schistosomes, leprosy, typhus, malaria, filariae, leishmanias, and tuberculosis. It also provides evidence for the parasitic stress theory of disease developed by Thornhill and Fincher (2014). The creation of the index was possible thanks to epidemiological information from the early 20th century and the archives of historical epidemiological atlases of infectious diseases. The combination of these two data sources allowed the authors to obtain a concrete measure of historical disease prevalence. Figure 3 above shows the geographical distribution of historical disease prevalence.

Figure 3 Distribution of histories of disease prevalence around the world



Source: *construction by Authors based on data from Murray andSchaller (2010); Africa and South America have experienced a higher prevalence of infectious diseases than the rest of the world.*

3.1.4. The control variables

Following the work on the comparative economic development literature (Ali et al., 2020; Ang & Fredriksson, 2021; Vu, 2021a), we control for a variety of factors which influence entrepreneurship at the individual country level. First, we include religion, level of development [2]and colonial origin. That is, dummy variables related to the origins of a nation's legal system (French, English, German and Scandinavian), and culture (Bennett & Nikolaev, 2021). Subsequently, the potential determinants of entrepreneurship developed by Maâlej (2013), Draghici and Albulescu (2014), Dvouletý (2018) and Tunali and Sener (2019) are also considered. These are the variables such as foreign direct investment, unemployment, freedom in business, level of democracy and human capital. We also take into account the geographical variables (Sternberg, 2007) and the set of control variables which in general are held constant in the literature) as well as the origin of the continents which allows here to take into account the level of development. We also control our estimates by other historical and social cultural characteristics (religion, ancestral biodiversity, pre-colonial institutions ethnic fragmentation). The classification of countries by income, fragility, and size is also taken into account. The combination of these variables is done in a sample that consists of a maximum of 125 countries. Appendix 1 and 2 present the descriptive statistics and the correlation matrix. The complete list of countries can be found in Appendix 3.

3.2 Methodology

Following the methodological approach of Bennett and Nikolaev (2021), with a cross-sectional specification with respect to the nature of the variable "historical prevalence of infectious diseases", several estimation methods are used to test our hypothesis. We start with ordinary least squares (OLS). This technique in the sense of Wooldridge (2010) allows us to analyze the direct effect of disease infection on entrepreneurship. The specification of the model is defined in cross section through the following equation:

$$\boldsymbol{GEI_i = \alpha + \beta . hpid_i + \sigma . X_i + \varepsilon_i}$$

In this equation $\boldsymbol{GEI_i}$ is the average of the overall entrepreneurship index of country i between 2007 and 2016; $\boldsymbol{hpid_i}$ is the historical prevalence index of infectious diseases;X_i is a control variable matrix and ε_i the error term. This method allowed the study to test the validity of the employed instrumental variable. In order to test the potential mediating impact of institutions on

[2] i.e. the probability that two randomly selected people in a country's population belong to the same ethnic group (Bennett & Nikolaev, 2021)

the relationship between disease prevalence and entrepreneurship, we used the double least squares estimator. The latter allows us to circumvent endogeneity problems. Our results are then subjected to several sensitivity and robustness tests. We first test the sensitivity of our OLS results to each country's continental origin, social cultural, historical and economic characteristics.

4. Results and discussion

In this section, we comment on the basic results and perform a mediation analysis to identify some transmission channels.

4.1. Base line results

Figure 4: Historical disease prevalence, institution and entrepreneurship

Source: authors' construction

Figure 4 above shows three correlation relationships. Historical prevalence of infectious diseases is negatively correlated with institutions and current entrepreneurship in our sample countries. In

contrast, institutions (property rights) are positively correlated with entrepreneurship. Table 1 below presents the results of ordinary least squares regressions of entrepreneurship on historical disease prevalence. Model 1 is a simple regression obtained from the two main variables. The results show that historical disease prevalence has a large and statistically significant negative effect on entrepreneurship. The value of the coefficient of determination "R^2" is 0.49, which suggests that the historical prevalence of the disease alone explains almost half of the variation in entrepreneurship across countries today. Model 2 incorporates colonial background. Model 3 takes into account religious culture. Model 4 incorporates level of development as measured by per capita GDP. Model 5 takes culture into consideration while Model 6 finally incorporates institutions measured by the protection of property rights. Despite the inclusion of these variables, the historical prevalence of diseases remains negatively and highly significantly correlated at the 1% level with entrepreneurship up to Model 4, which confirms our Hypothesis 1. The percentage increase in pathogens is associated with a decrease in entrepreneurship outcomes, all other things being equal. Finally, in Models 5 and 6, we take into account the Culture (Individualism / collectivism) and the Institutions (protection of property rights). At the same time, we find that the predicted coefficient on the institutions variable is highly statistically and economically significant, with a 1 point increase in property rights protection associated with an increase in entrepreneurship.

Several other results in Table 2 are worth mentioning. First, the variables in our most comprehensive model (column 7) jointly explain more than 80 percent of the variation in entrepreneurship outcomes across countries. Second, countries with historical contacts through colonization in general are more entrepreneurial. This corroborates the findings of Bennett andNikolaev (2021) in the context of innovation.

Overall, these results support Hypothesis 2, but we must be cautious in interpreting these results as causal for several reasons. First, countries with high levels of entrepreneurship are likely to have higher levels of economic growth and development, which may not only foster the development of values but also negatively influence the quality of institutions as demonstrated by the New Economics of Institutions theory (Acemoglu et al., 2003). In fact, according to this theory, in the framework of developing countries (Argentina and Ghana), the first political leaders favored the emergence of an elite in collusion with the power in place. This led to a discriminatory distribution of property rights. These results may also present an omitted variable bias that is correlated with both institutions and entrepreneurship. This problem may be

attenuated if we have a valid instrumental variable that is highly correlated with institutions and does not have a direct effect on entrepreneurship. The other problem with our results is the risk of multicollinearity between the independent variables in our model. Table 2 below presents this test. We note that none of our variables displays a VIF(variance inflation factor) greater than 10 or even less than 1/VIF less than 0.1. In other words, the tolerance threshold for multi-collinearity has been respected.

Table 1. Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable**: Global Entrepreneurship**						
	OLS	OLS	OLS	OLS	OLS	OLS
Disease pathogen	-22.266***	-19.020***	-18.535***	-10.066***	-3.023	-2.569
	(1.851)	(2.087)	(2.124)	(2.442)	(3.551)	(4.030)
German legal origin		16.175***	13.952***	3.962	2.014	2.666
		(3.613)	(4.102)	(4.810)	(5.202)	(5.206)
French legal origin		-4.367	-3.831	-2.747	-2.651	-1.585
		(2.846)	(3.095)	(2.762)	(3.162)	(3.022)
Scandinavian legal origin		18.437***	19.177**	9.244	7.827	5.915
		(3.811)	(8.065)	(7.183)	(7.150)	(8.076)
Catholic trust			0.048	0.024	-0.017	0.021
			(0.049)	(0.039)	(0.037)	(0.040)
Muslim trust			-0.081	-0.096**	-0.074	-0.003
			(0.052)	(0.048)	(0.063)	(0.054)
Protestant trust			-0.015	-0.014	-0.043	0.034
			(0.096)	(0.073)	(0.085)	(0.109)
GDP per capita				0.001***	0.001**	0.000
				(0.000)	(0.000)	(0.000)
Individualism/collectivism					0.198**	0.157
					(0.086)	(0.095)
Average Expropriation Risk						4.217***
						(1.287)
Constant	27.374***	28.325***	29.375***	21.984***	20.735***	-10.228
	(1.410)	(2.219)	(3.900)	(3.430)	(4.406)	(9.553)
Countries	125	121	114	114	63	57
R^2	0.49	0.59	0.66	0.72	0.78	0.82
Fisher	144.77***	141.92***	78.54***	58.18***	28.46***	34.03***

Notes: regressions of Entrepreneurship on disease pathogens. See Appendix 1 for variable descriptions and sources. ***, ** and * respectively indicate the significance of the coefficients at the 1%, 5% and 10% levels. Robust standard errors are in parentheses OLS = ordinary least squares

Source: Authors'

Table 2. Variance Inflation Factors	VIF	1/VIF
Protestant trust	5.29	0.189203
GDP per capita	4.88	0.204967
Scandinavian legal origin	4.03	0.248418
Average Expropriation Risk	3.99	0.250528
Individualism/collectivism	3.14	0.318393
Disease pathogen	2.78	0.360053
Catholic trust	2.39	0.418389
French legal origin	1.93	0.517675
Muslim trust	1.84	0.544554
German legal origin	1.43	0.700536
Mean VIF	3.17	

Note. Variance Inflation Factor (VIF) values for model 6 of Table 1.
Source: Authors' construction

Therefore, Model 6 in Table 1 provides a qualified assessment of the validity of our disease prevalence instrumental variable. Specifically, a critical assumption of our 2SLS-oriented model is that disease prevalence affects entrepreneurship only through protection of property rights (Average Expropriation Risk), holding other factors constant. In contrast, we find that disease prevalence is a non-significant predictor of entrepreneurship after controlling for protection of property rights (Average Expropriation Risk) .Model 6 suggesting that institutions can be considered as transmission channel(Zelekha, 2016). We also find that our instrument (disease prevalence) can potentially impact entrepreneurship through the culture channel as demonstrated by Bennett and Nikolaev (2021) in the context of innovation. Similarly, the behavior of the level of development measured by GDP per capita may also be a significant channel. This would suggest that we have solved the endogeneity problem, especially since the significance of the prevalence of infectious diseases disappears in Model 6. Moreover, innovation which is a determinant of entrepreneurship (Zhao et al., 2012), is in turn determined by the history of epidemics (Bennett & Nikolaev, 2021). Natkhov and Vasilenok (2021) also show that in Russia, innovation is strongly determined by past German migration flows. This observation leads us to propose a mediation test on our variable and the other variables recognized by the literature (GDP per capita; culture; level of digitalization of economies).

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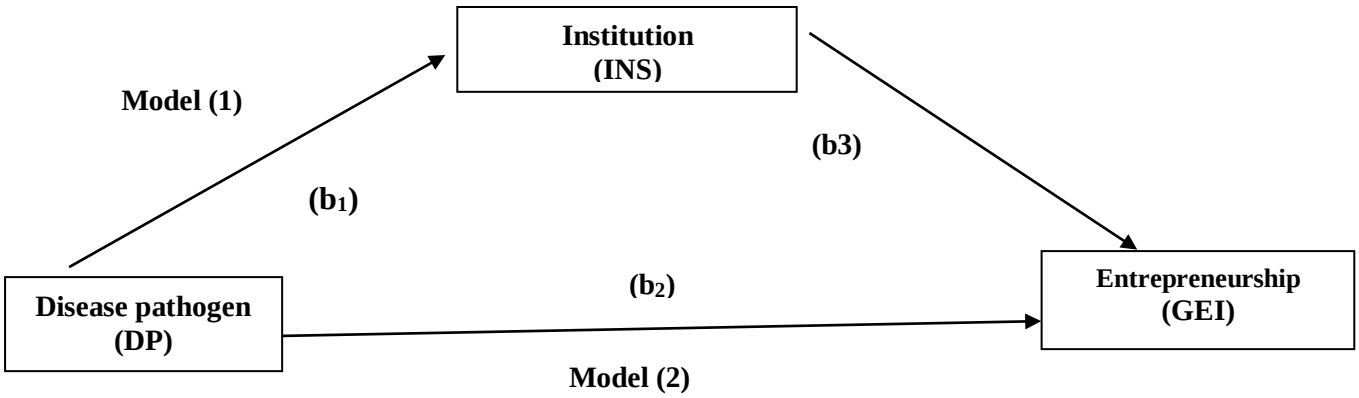
4.2.Mediation analysis

The idea of conducting a mediation analysis is motivated by several works. Tunali andSener(2019) for example, show that income level determines entrepreneurial ability. Alsan(2015) on the other hand, empirically states that a country's income level is determined by its epidemiological history in the context of sleeping sickness in Africa. Model 4 in our Table 1 demonstrates this moreover. To highlight this mediation, we test its effectiveness and measure its magnitude like Ang and Fredriksson (2021). This test is developed using the approaches of Baron and Kenny (1986) and Zhao et al. (2010). According to Baron and Kenny (1986), there is no mediation if the historical prevalence of diseases has no effect on the mediator (institutions) and/or if the institutions (mediator) have no effect on entrepreneurship. There is "some" mediation if the above effects are both significant, in which case (i) mediation is complete if the test for the indirect effect is significant, but not the direct effect; (ii) it is partial if only one of the direct and indirect effects is significant; or (iii) none is significant.

Figure 5: Transmission mechanisms of historical prevalence of infectious diseases



Model 1 : $\boldsymbol{INS_i = \alpha_1 + b_1.DP_i + c'_1 controls_i + u_i}$

Model 2: $\boldsymbol{GEI_i = \alpha_2 + b_2.DP_i + b_3.INS_i + c'_2 controls_i + v_i}$

Indirect effect $= \boldsymbol{b_1 X b_2}$; direct effect $= \boldsymbol{b_2}$; $total\ effect = \boldsymbol{b_1 X b_3 + b_2}$

Looking at the Zhao et al. (2010) approach, mediation is not considered to exist if the coefficient of the indirect effect obtained by the Monte Carlo z-test is not significant. We speak of complete mediation if the indirect effect test is significant, but not the direct effect of the historical prevalence of diseases. On the other hand, mediation will be partial if the direct effect is significant. Mediation is considered complementary if the indirect and direct effects are in the

same direction. Otherwise (effects are of opposite signs) mediation will be concurrent. The results of our mediation test are presented in Table 3. Overall, the institutions variable, like the individualist culture, is a partial and complementary mediator with a mediation evaluated at nearly 42% of the total effect. We also notice that the level of income (GDP per capita) and the digitalization of economies are mediating variables with a mediation capacity evaluated at more than 70% of the total effect. The result of this mediation test allows us to confirm the historical prevalence of diseases as a good instrument for our following analyses and institutions measured here by the protection of property rights as a transmission channel.

Table 3: Mediation analysis using the structural equation method

	(1)	(2)	(3)	(4)
Variable mediation	Institution.	GDP per capita	Digitalization.	Culture
Mediation trough Disease pathogen				
Step 1 (X -> M)	-0.656***	-0.741***	-0.695 ***	-0.735 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Step 2 (M -> Y)	0.473***	0.651 ***	0.778 ***	0.548 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Step 3 (X -> Y)	-0.437***	-0.171*	-0.029	-0.484***
	(0.049)	(0.063)	(0.780)	(0.000)
Sobel test (of	-0.310***	-0.483***	-0.540 ***	-0.403 ***
indirect effect)	(0.000)	(0.000)	(0.000)	(0.000)
RIT	0.415	0.739	0.949	0.454
RID	0.710	2.824	18.792	0.831
Conclusion ZLC	complementary partial mediation	Full mediation	Full mediation	complementary partial mediation
Conclusion BK	Partial mediation	Complete mediation	Complete mediation	Partial mediation

Notes: This table reports the partial results of structural equation modelling and distinguishes direct and indirect effects. P-values are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. ZLC: Zhao, Lynch and Chen (2010); BK: Baron and Kenny (1986).

Source: Authors' construction

5. Sensitivity tests

5.1. Robustness to endogeneity concerns

Historical prevalence of diseases, institutions and entrepreneurship

The main point being emphasized here is that the historical prevalence of disease explains the differences in entrepreneurship between countries. As stated in the Value Theory of Parasitic Stress, a distinction must be made between collectivist and individualist societies. The former (collectivist societies) consisted of people living in areas with a high prevalence of disease. The latter were more likely to develop cultural values associated with more collectivist societies in which people arranged to be in harmony with the powerful lobbies at the expense of property

rights. The second (individualistic society) results in less epidemic areas with a leitmotif of encouraging private initiative and property rights. The work of Michalopoulos and Papaioannou (2013) and Alsan (2015) under the control of the Diamond (1997) theory emphasize that countries with a strong epidemic past were characterized by weak institutions and are less developed nowadays. Our hypothesis suggests that the strong association between pathogens and entrepreneurship is transmitted through the channel of institutions (Hypothesis 3), as societies in which property rights are guaranteed incentivize entrepreneurship.

Two observations can be made from Figure 4 above. First, institutions are positively correlated with entrepreneurship. Second, there is a negative correlation between historical disease prevalence and property rights protection. To test the theory that institutions serve as a transmission mechanism for pathogens to entrepreneurship, we use a 2SLS model in which entrepreneurship outcomes are the dependent variable, property rights protection is the endogenous independent variable, and pathogen prevalence is the exogenous instrumental variable excluded from the second stage of the analysis. In other words, we use historical disease prevalence as an instrument for property rights protection, which then predicts entrepreneurship in the next stage. The results of the second stage of our 2SLS analysis are presented in Table 4 below. These results are derived from an exactly identified model. The results show that the effect of historical disease prevalence does indeed pass through to the protection of property rights. Model 1 shows a bivariate regression where only the variable.

Table 4: taking endogeneity into account

	(1)	(2)	(3)	(4)	(5)	(6)
	IV: Historical infection diseases					
	Dependent variable: entrepreneurship					
Method	(2sls)	(2sls)	(2sls)	(2sls)	(2sls)	(2sls)
Average Expropriation Risk	14.633***	14.819***	14.469***	14.129***	14.644***	15.056***
	(1.776)	(2.038)	(1.860)	(1.819)	(1.958)	(1.907)
Foreign Direct Investment		-0.137				
		(0.521)				
Unemployment			-0.227			
			(0.372)			
Business freedom				-0.153		
				(0.131)		
Institutionalized autocracy					-0.003	
					(0.237)	
Democracy						-0.110
						(0.182)
Constant	-80.032***	-81.220***	-75.624***	-66.072***	-79.201***	-82.644***
	(14.910)	(16.529)	(16.540)	(18.340)	(16.328)	(16.033)
Geography controls	Yes	Yes	Yes	Yes	Yes	yes
Colonization controls	Yes	Yes	Yes	Yes	Yes	yes
Countries	87	87	84	83	82	82
R^2	0.49	0.48	0.53	0.50	0.50	0.47
Fisher	26.79***	22.35***	23.04***	19.55***	20.74***	21.43***

Notes: This table reports 2SLS estimates of the effects of historical prevalence of diseases on Entrepreneurship. The model is exactly identified. We consider Average Expropriation Risk as a transmission channel. Robust standard errors are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Authors' construction

The protection of property rights instrumented is included on the right side a bivariate regression where only the index of individualism instrumented is included on the right side. Subsequently, the following models successively add controls for the approximate determinants of entrepreneurship (Dvouletý, 2018). Model 2 considers the flow of incoming foreign direct investment. Model 3 reflects unemployment, Model 4 consider trade freedom, Model 5 acknowledges autocracy while Model 6 shows democracy. Property rights (institutions) remain statistically significant at the 1% level in all models. The disease prevalence index is also a significant predictor of property rights values in all first-level models. These results are consistent with hypothesis 3 and suggest that an increase in the standard deviation of pathogens is associated with a decrease in property rights.

Overall, the results of our 2SLS analysis support Hypotheses 2 and 3, suggesting that the effect of pathogens on entrepreneurship is transmitted through the institutional channel of property rights protection. The effect is also economically significant. The coefficient estimates suggest that a one standard deviation increase in institutions is associated with a one standard deviation increase in entrepreneurship outcomes.

5.2. Robustness in relation to the entrepreneurship sub-indices

We conduct here a robustness test by decomposing the entrepreneurship index. The methodology proposed by the Global Entrepreneurship and Development Institute decomposes entrepreneurship into three sub-indices: entrepreneurial attitudes, entrepreneurial capacity and entrepreneurial aspirations. Table 5 below presents these results obtained by the 2SLS. We obtain an identical result as when the global index was employed. Accordingly, the historical prevalence of diseases significantly predicts entrepreneurship through institutions.

Table 5: Robustness in relation to the entrepreneurship sub-indices

	(1)	(2)	(3)
	IV: Historical infection diseases		
Dependent variable:	Entrepreneurial Attitudes	Entrepreneurial Abilities	Entrepreneurial Aspirations
Method	2sls	2sls	2sls
Average Expropriation Risk	**15.104*** **	**15.521*** **	**13.274*** **
	(2.091)	**(1.915)**	**(1.828)**
Constant	-83.974***	-87.353***	-68.770***
	(17.810)	(16.115)	(15.213)
Countries	87	87	87
R^2	0.38	0.46	0.57
Fisher	21.70***	24.81***	27.65***
Geography controls	Yes	Yes	yes

Colonization controls	Yes	Yes	yes

Notes: This table reports 2SLS estimates of the effects of historical prevalence of diseases on the sub index pillar of Entrepreneurship. The model is exactly identified. We consider Average Expropriation Risk as a transmission channel. Robust standard errors are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Authors' construction

5.3. Robustness to using an alternative measureof property rights.

The rest of the analysis leads us to use two other alternative measures of institutions in relation to Average Expropriation Risk. It should be noted that despite the relevance of the protection of property rights proposed by Acemoglu et al. (2001), some limitations deserve to be corrected. First, the variable dates from 1995 whereas we are in 2021. Second, several events such as financial crises and conflicts have disrupted the institutional framework of many countries in our sample. To compensate for this shortcoming, we use two fairly recent measures of property rights protection. These are "Security of property rights" and "Security of private contracts" proposed by the "Institutional Profile Database" proposed in 2016 under the coordination of the French Treasury (Bertho, 2013). Tables 5 and 6 below are obtained by the 2SLSmethod. Our instrument remains unchanged (i.e. historical disease prevalence). We find that the two alternative measures of property rights instrumented by the historical prevalence of diseases significantly explain the overall entrepreneurship index.

Table 6: **Security of private contracts**

	(1)	(2)	(3)	(4)
	IV: Historical infection diseases			
Dependent variable:	Global Entrepreneurship	Entrepreneurial Attitudes	Entrepreneurial Abilities	Entrepreneurial Aspirations
Method	2sls	2sls	2sls	2sls
Security of private contracts	**16.996*** **	**16.826*** **	**18.428*** **	**15.734*** **
	(4.729)	**(5.071)**	**(4.797)**	**(4.904)**
Geography controls	Yes	Yes	Yes	yes
Colonization controls	Yes	Yes	Yes	yes
Constant	-21.865**	-23.517**	-26.950**	-15.128
	(10.936)	(11.170)	(10.690)	(12.579)
Countries	84	84	84	84
R^2	0.58	0.48	0.58	0.61
Fisher	29.42***	22.98***	29.19***	32.37***

Notes: This table reports 2SLS estimates of the effects of historical prevalence of diseases on the sub index pillar of Entrepreneurship. We consider another measures of Average Expropriation Risk(**Security of private contracts)** as a transmission channel. Robust standard errors are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Authors' construction

It is also noted that this persists on attitudes, capacity and aspirations for entrepreneurship which are considered here as the pillars for an entrepreneurial society. This result is consistent with the work of Chowdhury and Audretsch (2018) for whom institutions are an essential variable of entrepreneurship.

Table 7: **Robustness with Security of property rights**

	(1)	(2)	(3)	(4)
	IV: Historical infection diseases			
Dependent variable:	Global Entrepreneurship	Entrepreneurial Attitudes	Entrepreneurial Abilities	Entrepreneurial Aspirations
Method	2sls	2sls	2sls	2sls
Security of property rights	**54.243*** **	**55.248*** **	**59.085*** **	**48.397** **
	(19.105)	**(19.864)**	**(19.049)**	**(19.434)**
Geography controls	Yes	Yes	Yes	yes
Colonization controls	Yes	Yes	Yes	yes
Constant	-104.618**	-108.345**	-117.446**	-88.064*
	(50.637)	(52.848)	(50.202)	(51.709)
Countries	62	62	62	62
Fisher	8.61***	7.20***	7.92***	11.06***

Notes: This table reports 2SLS estimates of the effects of historical prevalence of diseases on the sub index pillar of Entrepreneurship. The model is exactly identified. We consider another measures of Average Expropriation Risk(**Security of property rights)** as a transmission channel. Robust standard errors are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Authors' construction

5.4.Robustness to additional controls

Additional controls on our baseline results take into account continental fixed effects, the World Bank's classification of countries by income, the level of fragility of each country's size, and the level of development. We also take into account the historical and cultural characteristics of the countries in our sample. The results of these controls are presented in Appendices 4, 5 and 6. Our results remain unchanged.

6 . Conclusion and future research directions

The study of the driving forces behind persistent high levels of entrepreneurship appears to be the most important inquiry in mainstream economics. Previous studies reveal the persistence effects of historical prevalence of infectious diseases, across culture. The novelty of this article lies in the adoption of a historical approach that highlights the deep historical roots of differences in economic development across countries.

This article is part of a successful line of research that examines the effects of the age of environmental quality on institutions, innovation and entrepreneurship across countries. For example, Alsan (2015) who demonstrated that the wealth of nations has been determined by historical causes. This article therefore provides further support for the importance of property rights between historical prevalence of infectious diseases and entrepreneurship (Bennett et al., 2017; Bennett & Nikolaev, 2021).

The central hypothesis is that property rights protection reduces the effect of the historical pathogen on entrepreneurship. Specifically, the historical pathogen determines inclusive versus extractive institutions (Acemoglu et al., 2001; Giuliano & Nunn, 2018; Michalopoulos & Papaioannou, 2013). Using data for 125 countries, we find strong and robust evidence on the proposed hypothesis and other results. Property rights are higher in countries where disease prevalence was low. This leads to high scores in entrepreneurship. In contrast, countries with high disease prevalence did not have time to build strong institutions to secure property rights. This explains their low level of entrepreneurship today. This result is robust to the change in methodology and alternative measures of property rights. Furthermore, our results also confirm the level of development, culture and digitalization of economies as also being channels of transmission between past diseases and the current level of entrepreneurship.

The study obviously leaves room for further research, especially as it pertains to assessing how historical factors are affecting the current drive towards sustainable development goals. Moreover, assessing whether the findings in this study withstand empirical scrutiny when other channels and instruments are employed is worthwhile.

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Appendix 1 :Descriptive statistics

Variables	Sources	Obs	Mean	Std. Dev.	Min	Max
Global Entrepreneurship	GEI	125	24.365	20.638	.09	73.742
Disease pathogen	(Murray & Schaller, 2010)	125	.135	.651	-1.31	1.17
Average Expropriation Risk	(Acemoglu et al., 2001)	95	7.348	1.67	3.636	10
Security of property rights	IPD	82	2.436	.492	1.25	3.5
Security of private contracts	IPD	111	2.689	.932	0	4
Foreign Direct Investment	WDI	123	3.664	5.144	-4.054	41.193
unemployment	WDI	120	7.844	5.66	.825	32.226
business freedom	FREEDOM HOUSE	118	65.157	12.974	27.708	98.129
British colonization dummy	(Acemoglu et al., 2001)	115	.278	.45	0	1
Frenche colonization dummy	(Acemoglu et al., 2001)	115	.139	.348	0	1
Foreign Direct Investment	WDI	123	3.664	5.144	-4.054	41.193
total unemployement	WDI	120	7.844	5.66	.825	32.226
business freedom	Freedom house	118	65.157	12.974	27.708	98.129
Polity combined score	Polity 4	116	-1.65	13.774	-66	10
Landlocked	(Comin et al., 2010)	107	.168	.376	0	1
Tropical dummy	(Comin et al., 2010)	107	.477	.502	0	1
Distance to equator	(Comin et al., 2010)	100	.295	.194	.003	.669
Europe dummy	(Comin et al., 2010)	107	.299	.46	0	1
Africa dummy	(Comin et al., 2010)	107	.308	.464	0	1
Asia dummy	(Comin et al., 2010)	107	.224	.419	0	1
America dummy	(Comin et al., 2010)	107	.159	.367	0	1
British colonization dummy	(Giuliano & Nunn, 2018)	115	.278	.45	0	1
Frenche colonization dummy	(Acemoglu et al., 2001)	115	.139	.348	0	1
Biogeography	(Olsson & Hibbs, 2005)	89	53.07	40.623	12.353	100
Pre-colonial political centraliz	(Acemoglu et al., 2001)	123	.849	.258	0	1
German legal origin	(Acemoglu et al., 2001)	122	.041	.199	0	1
French legal origin	(Acemoglu et al., 2001)	121	.529	.501	0	1
scandinavian legal origin	(Acemoglu et al., 2001)	122	.041	.199	0	1
catholic trust	(Acemoglu et al., 2001)	115	31.602	35.924	0	96.9
muslim trust	(Acemoglu et al., 2001)	115	23.691	35.798	0	99.4
protestant trust	(Acemoglu et al., 2001)	121	12.202	21.634	0	97.8
gdp per capita	WDI	123	7182.853	8765.249	153.095	38834.801
Individualisim/collectivisim	(Hofstede, 2011)	66	43.364	23.858	6	91
High income countries	World bank classification	123	.299	.418	0	1
Upper middle income countries	World bank classification	123	.218	.293	0	1
Least developed countries	World bank classification	125	.112	.317	0	1
Lower middle income countries	World bank classification	123	.253	.306	0	1
Low income countries	World bank classification	123	.23	.369	0	1
Small island developing states	World bank classification	125	.192	.395	0	1
Small states	World bank classification	125	.04	.197	0	1
Fragile and conflicted affected	World bank classification	125	.104	.306	0	1

Source: authors' construction

Appendix 2: correlation matrix

	(1) gei	histo_patho	withxpr	f_brit	f_french	landlocked	tropical	distequat	eu	af	as	am
gei	1											
histo_patho	-0.702***	1										
	(0.000)											
withxpr	0.792***	-0.678***	1									
	(0.000)	(0.000)										
f_brit	-0.0616	0.130	-0.0228	1								
	(0.513)	(0.168)	(0.827)									
f_french	-0.365***	0.376***	-0.298**	-0.250**	1							
	(0.000)	(0.000)	(0.003)	(0.007)								
landlocked	-0.135	-0.0231	-0.0876	0.0272	0.0947	1						
	(0.167)	(0.814)	(0.420)	(0.787)	(0.346)							
tropical	-0.571***	0.647***	-0.531***	0.118	0.275**	0.0711	1					
	(0.000)	(0.000)	(0.000)	(0.241)	(0.005)	(0.467)						
distequat	0.687***	-0.803***	0.651***	-0.206*	-0.248*	-0.0893	-0.876***	1				
	(0.000)	(0.000)	(0.000)	(0.046)	(0.015)	(0.377)	(0.000)					
eu	0.506***	-0.716***	0.664***	-0.324***	-0.269**	0.0882	-0.623***	0.793***	1			
	(0.000)	(0.000)	(0.000)	(0.001)	(0.007)	(0.366)	(0.000)	(0.000)				
af	-0.543***	0.595***	-0.482***	0.199*	0.449***	0.187	0.416***	-0.466***	-0.436***	1		
	(0.000)	(0.000)	(0.000)	(0.046)	(0.000)	(0.054)	(0.000)	(0.000)	(0.000)			
as	-0.0521	0.168	-0.0408	0.223*	-0.0319	-0.182	0.0700	-0.129	-0.351***	-0.359***	1	
	(0.594)	(0.084)	(0.707)	(0.025)	(0.752)	(0.061)	(0.474)	(0.200)	(0.000)	(0.000)		
am	0.0656	-0.0297	-0.127	-0.152	-0.195	-0.127	0.199*	-0.207*	-0.284**	-0.290**	-0.234*	1
	(0.502)	(0.761)	(0.240)	(0.129)	(0.050)	(0.192)	(0.039)	(0.039)	(0.003)	(0.002)	(0.015)	
N	125											

Note: Gei: Global entrepreneurship; histo_patho: Disease pathogen; avexpr: Average Expropriation Risk; f_brit:britanique colonization; f_french: frenche colonization; landlocked:geographic position; tropical:l tropical dumy; distequat:distznce to equatoreu :European dummy; af: African dummy; as: Asian dummy; am: americzn dummy

*,**,*** denote significance levels at 10%, 5% and 1% respectively.

Source: authors' construction

Appendix 3: list of countries

List of Countries				
Albania	China	Iceland	Mauritania	Singapore
Algeria	Colombia	India	Mayanmar	Slovakia
Angola	Costa Rica	Indonesia	Mexico	Slovenia
Argentina	Ivory Coast	Iran	Moldova	South Africa
Armenia	Croatia	Ireland	Morocco	Spain
Australia	Cyprus	Israel	Mozambique	Sri Lanka
Austria	CzechRep.	Italy	Namibia	Suriname
Azerbaijan	Denmark	Jamaica	Netherlands	Swaziland
Bahrain	Ecuador	Japan	Nigeria	Sweden
Bangladesh	Egypt	Jordan	Norway	Switzerland
Belgium	El Salvador	Kenya	Oman	Syria
Benin	Estonia	Korea south	Pakistan	Tanzania
Bolivia	Ethiopia	Kuwait	Panama	Thailand
Bosnia	Finland	Laos	Peru	Trinidad and tobago
Botswana	France	Latvia	Philippines	Tunisia
Brazil	Gabon	Lebanon	Poland	Turkey
Brunei	Gambia	Liberia	Portugal	Uganda
Bulgaria	Georgia	Libya	Puerto Rico	Ukraine
Burkina faso	Germany	Lithuania	Romania	United Arab emirate
Burundi	Ghana	Luxembourg	Russia	United Kindom
Cambodia	Greece	Macedonia	Rwanda	Uruguay
Cameroon	Guatemala	Madagascar	Saudi arabia	USA
Canada	Guinea	Malawi	Senegal	Venezuela
Chad	Hong Kong	Malaysia	Serbia Montengro	Vietnam
Chile	Hungary	Mali	sierra leone	Zambia

Source: authors' construction

Appendix 4: controlling by continent dummy

	(1)	(2)	(3)	(4)
	Dependent variable: entrepreneurship			
	OLS	OLS	OLS	OLS
Disease pathogen	-11.615***	-15.019***	-12.017***	-14.963***
	(4.287)	(3.752)	(3.949)	(3.952)
Africa dummy	-8.235**			
	(3.821)			
Asia dummy		-2.684		
		(3.871)		
America dummy			8.023**	
			(3.799)	
Europe dummy				5.217
				(5.117)
Constant	22.460**	27.900**	16.448	28.857**
	(11.252)	(11.861)	(12.282)	(12.269)
Comments	87	87	87	87
R^2	0.69	0.68	0.69	0.68
Fisher	20.71***	20.85***	23.10***	19.93***

*,**,*** denote significance levels at 10%, 5% and 1% respectively.

Source: authors' construction

Table 5: Robustness to controlling for historical confounders and othersocial and cultural effects

	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(10)
	Dependent variable: entrepreneurship								
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Disease pathogen	-13.604***	-13.663***	-15.142***	-14.885***	-13.672***	-13.612***	-15.526***	-14.892***	-14.827***
	(3.949)	(3.982)	(3.870)	(3.883)	(3.791)	(3.450)	(3.762)	(3.809)	(3.812)
Biogeography	0.100								
	(0.070)								
Pre-colonial political centralization		8.464							
		(6.148)							
Ex-colony dummy			-1.508						
			(4.378)						
Ethnic fragmentation				-14.412*					
				(7.467)					
Percent Christian					7.023				
					(4.726)				
Percent Muslim						-12.606***			
						(4.154)			
Percent Unaffiliated							26.558**		
							(10.774)		
Percent Hindu								-4.054	
								(9.478)	
Percent Buddhist									-5.843
									(11.331)
Constant	21.072*	17.970	28.085**	34.528***	23.613**	33.275***	24.137**	26.213**	26.492**
	(12.429)	(12.954)	(12.230)	(11.901)	(11.617)	(10.721)	(11.406)	(12.019)	(11.780)
Countries	70	87	87	87	87	87	87	87	87
R^2	0.75	0.68	0.68	0.70	0.69	0.72	0.70	0.68	0.68

Source: authors' construction*,**,*** denote significance levels at 10%, 5% and 1% respectively.

Appendix 6: Robustness to controlling for other economic characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: entrepreneurship							
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Disease pathogen	-7.769**	-15.189***	-14.528***	-7.448**	-13.656***	-11.532***	-14.191***	-14.968***
	(3.339)	(3.880)	(3.749)	(3.430)	(3.816)	(3.496)	(3.877)	(3.819)
High income countries	26.047***							
	(3.270)							
Upper middle income countries		-1.816						
		(5.738)						
Lower middle income countries			-7.451*					
			(4.233)					
Low income countries				-25.766***				
				(4.577)				
Least developed countries					-6.251			
					(3.876)			
Small island developing states						-15.710***		
						(3.405)		
Small states							14.544	
							(9.056)	
Fragile and conflicted state								-3.860
								(4.810)
Constant	26.711***	26.520**	30.689**	26.653***	26.882**	23.586**	21.762*	24.149**
	(9.959)	(12.300)	(12.113)	(9.754)	(11.573)	(10.704)	(12.107)	(12.080)
Countries	87	87	87	87	87	87	87	87
R^2	0.80	0.68	0.69	0.76	0.69	0.73	0.69	0.68

*,**,*** denote significance levels at 10%, 5% and 1% respectively.

Source: authors' construction