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DO ENTREPRENEURSHIP AND SECTORAL OUTPUTS SUPPORT SUSTAINABLE DEVELOPMENT: A LITERATURE REVIEW AND AN EMPIRICAL ASSESSMENT FOR DEVELOPED COUNTRIES

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ABSTRACT

The objective of this paper is to explore the relationship between entrepreneurship and sectoral outputs and three dimensions of sustainable development using the FMOLS technique for a panel of 21 developed countries covering the period 2001-2016. Our empirical results reveal that entrepreneurship and sectoral outputs have a significant positive impact on economic growth. They also indicate that entrepreneurship and sectoral outputs could play an essential role in resolving environmental problems. Our findings also show that entrepreneurship and sectoral outputs can support human development. On a global level, we can say that entrepreneurship and sectoral outputs could reinforce sustainable development.

Contribution/ Originality: This study is one of very few studies to have simultaneously investigated the effects of entrepreneurship and sectoral outputs on the dimensions of sustainable development. We conclude that entrepreneurship and sectoral outputs are essential. They can help increase standards of living and produce wealth.

1. INTRODUCTION

"We are determined to protect the planet from degradation including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations."[1]

Both entrepreneurship and sectoral outputs have a key role in increasing the dynamism of economies and helping with employment creation and improvement. In fact, for many years, entrepreneurship has been proposed as a motor of economic development in many countries (OECD, 1998; OECD, 2003; UN, 2004). Therefore, to achieve the sustainable development goals, nutritious food must be accessible to everyone, and natural resources must be used in a manner that keeps ecosystems functioning to meet present and future human needs. In line with this reasoning,

[1] General Assembly, 2015 "The 2030 Agenda: For people, planet and prosperity".

sectoral outputs (agriculture, industry, and service) actively contribute to sustainable development. These sectors offer decent employment situations and work in the right price environment. They allow communities to maintain food security and control their livelihoods and provide equitable access to sufficient resources.

In fact, the links between entrepreneurship and economic growth, and sectoral outputs and economic growth are important to support future global development, policy, and research. In this context, in 2001 the European Union adopted a strategy based on the economic, social, and environmental dimensions of sustainable development while recognizing the association of these factors (CEC, 2005). Therefore, given this background, it has become important to evaluate the contribution of entrepreneurship and sectoral outputs to achieving the sustainable development objectives in certain developed countries. The current study attempts to determine how entrepreneurship and sectoral outputs can simultaneously lead to economic growth and accomplish social and environmental goals. Although a considerable number of time-series studies, such as those of Thai and Turkina (2014); Dau and Cuervo-Cazurra (2014), and Omri and Dhahri (2018), have been carried out to determine the relationship between entrepreneurship and sustainability goals, there have been few empirical investigations on the contribution of sectoral outputs to sustainable development. Compared to other studies, ours aims at clarifying the contribution of entrepreneurship and sectoral outputs to each separate pillar of sustainable development. More precisely, the main objective of this paper is to investigate the relationship between entrepreneurship, sectoral outputs, and sustainable development for a panel of 21 developed countries over the 2001-2016 period. We used the Fully Modified Ordinary Least Squares (FMOLS) approach. The economic model incorporates the Cobb–Douglas production function to produce new evidence on the links between entrepreneurship, sectoral outputs, and the economic, environmental, and social dimensions of sustainable development. Moreover, the introduction of this function has helped us explore the causal relationships between the following variables: entrepreneurship, sectoral outputs, economic growth, environmental quality, and human development. Indeed, this method seems useful to clearly determine the role of each factor in achieving the sustainable development objectives and to easily detect whether or not entrepreneurial failure and sectoral products have occurred in this framework. This paper is organized as follows. After the introduction, which has identified the research gap and the aim of the study, Section 2 offers a literature review that covers the relationships between entrepreneurship and sustainable development and between sectoral output and sustainability. In Section 3, the study's methodology is presented, including the empirical setting, the sample, the data collection, and measures. Next, the results of the descriptive statistical analysis and the regression analysis are discussed and presented in Section 4. Section 5 discusses the results of the study and compares them with those of the prior literature. Finally, Section 6 concludes by presenting the study's contributions and recommendations.

2. OVERVIEW OF RELATED LITERATURE

2.1. Entrepreneurship and Sustainable Development Dimensions

2.1.1. Economic Effect of Entrepreneurship: Entrepreneurship and Economic Growth

Several authors dating back many years, including Schumpeter (1934); Schumpeter (1942); Romer (1986), and Lucas Jr (1988), have emphasized that capital and labor are not the only factors of economic growth. They have pointed out the necessity of knowledge as an important factor for production. The theoretical and empirical support offered by the research in this field is very rich. Theoretically, Schumpeter (1911) and Holcombe (1998) have shown that entrepreneurship can stimulate long-term economic growth. Moreover, a large volume of empirical research from the last two decades has found that entrepreneurship and economic growth may be jointly determined (e.g, Acs, Braunerhjelm, Audretsch, & Carlsson, 2009; Prieger, Bampoky, Blanco, & Liu, 2016). Most of the empirical results indicate that entrepreneurship positively influences economic growth (see, inter alia, Audretsch & Keilbach, 2004; Urbano & Aparicio, 2016; Van Stel & Storey, 2004). These authors have also indicated that occasional entrepreneurship rates reflect the creation of knowledge, which can indeed cause an increase in economic growth. Moreover, entrepreneurs, as agents of change and innovation, contribute to the reduction of unemployment (e.g.

Silvestre (2015) and Prieger et al. (2016)). These authors found that entrepreneurship stimulates economic growth through a process of competitiveness. However, many studies, such as those of Rahman (1999); Armendáriz de Aghion and Morduch (2000), and Kiiru (2007), have shown that entrepreneurship institutions are more likely to be oriented toward driven entrepreneurship opportunities to achieve social development objectives. In a similar study, Quatraro and Vivarelli (2015) indicated that surviving entrepreneurs can cause turbulence and negatively affect economic growth. In addition, increasing surviving entrepreneurship may be counterproductive from both environmental and economic points of view (Vivarelli, 2013).

2.1.2. Ecological Effect of Entrepreneurship: Entrepreneurship and Environmental Quality

Nowadays, climate change and environmental degradation are regarded as humanity's greatest challenges. In this area, a substantial body of literature has shown that many countries have put in place entrepreneurial policies to restore and sustain the environment. In this case, the World Council for Sustainable Development (WBCSD) advised business leaders to be committed to sustainability objectives, which comprise advocacy, policy development, promotion, and contribution to the sustainable future of developing nations (World Council for Sustainable Development, 2009). Dean and McMullen (2007) observed that within a global and political framework, entrepreneurship is intended to save the environment and maintain social responsibility. For their part, Cohen and Winn (2007) agreed with Dean and McMullen, stating that harnessing innovative entrepreneurship conserves the environment, which endorses the view of sustainable entrepreneurship.

Thus, the environment becomes a key factor in their argument, with little regard for social systems. Their purpose is to explore how the entrepreneurial enterprise relates to society and the environment, but not from just an economic point of view. Similarly, Katsikis and Kyrgidou (2007) revealed that entrepreneurship, as a teleological process, tends to achieve sustainable development by discovering, evaluating, and exploiting opportunities and creating value that leads to economic prosperity, social cohesion, and environmental protection. Additionally, Schaper (2002) reported that entrepreneurs could play an important role in solving environmental problems by creating new, more environmentally sustainable products and services. According to Hall, Daneke, and Lenox's (2010) panacea hypothesis, entrepreneurship could overcome many of our social and environmental problems and be the action needed to put us on the path to a more sustainable and healthy future (Brown, 2006; Brugmann & Prahalad, 2007).

Sustainable entrepreneurship is a sub-category of entrepreneurship; Crals and Vereeck (2004) indicated that sustainable entrepreneurship can be defined as businesses' continuing commitment to behave ethically and contribute to economic development while improving the quality of life of the workforce, their families, the local and global community, as well as future generations. Along similar lines, Crals and Vereeck (2004) pointed out that sustainable entrepreneurship is "the discovery and exploitation of economic opportunities through the generation of market disequilibria that initiate the transformation of a sector towards an environmentally and socially more sustainable state."

2.1.3. Social Effect of Entrepreneurship: Entrepreneurship and Human Development

It is widely thought that entrepreneurship is important to the development of nations. However, the role of the entrepreneur has been neglected in economics. In fact, economists have focused on the role of entrepreneurship in economic outputs, such as growth, productivity, and employment, and less on its role in human development. Hence, this part of the literature review links entrepreneurship and human development. According to Dean and McMullen (2007) and Shepherd and Patzelt (2011), entrepreneurial action is a necessary factor in the development of society as a whole. Also, Wheeler et al. (2005) and Senge, Lichtenstein, Kaeufer, Bradbury, and Carroll (2007) revealed that entrepreneurship could be a solution to various social problems. Moreover, Almeida, Bonilla, Giannetti, and Huisingh (2013) and Lozano, Lukman, Lozano, Huisingh, and Lambrechts (2013) emphasized that society needs more initiatives

and investment from enterprises, educational institutions, and governments to adopt innovative solutions in order to achieve sustainability goals. Hence, they believe that entrepreneurship offers a potential solution to social inequality.

On the other hand, taking into account the seminal contribution by Baumol (1990), it has become known that Schumpeterian innovative entrepreneurs coexist with defensive entrepreneurs, those who start a new business not because of market opportunities and innovative ideas, but simply because they need an income to survive. For various reasons, this kind of "survival-driven" self-employment is particularly common in African countries (Desai, 2009; Naudé, 2010; Yamada, 1996), where poverty and unemployment push a large number of people into entrepreneurial activities ranging from street vending to traditional and personal services (see, e.g Maloney, 2004; Sonobe, Suzuki, & Otsuka, 2011). A study by Amorós and Cristi (2011) focused on the relationship between entrepreneurship and human development indicators in some African countries. In fact, they provided empirical evidence for the hypothesis that, while this kind of entrepreneurship is hardly able to determine the economic performance of African countries, it nonetheless contributes to the reduction of inequality by affecting the wealth distribution in society. Similarly, Naudé (2010) analyzed the effects of entrepreneurship in some African countries using broader and more non-material and subjective measures of human well-being. The study showed that entrepreneurship in African countries may contribute to individual and societal development beyond a mere increase in GDP.

With this strand of literature, it becomes clear that entrepreneurship is a key factor in addressing the challenges of sustainable development. Due to its growing recognition as a driver of sustainable development, entrepreneurship is a subject of research across many scientific disciplines. Therefore, we can suppose that in developed countries, entrepreneurship is positively related to the three dimensions of sustainable development.

2.2. Sectoral Outputs and Sustainable Development Dimensions

2.2.1. How do Sectoral Outputs Influence Economic Growth?

Isiksal and Chimezie (2016) documented the effect of industrialization in Nigeria from 1997 to 2012 using Johansen's co-integration testing approach. They found that no country, particularly any developing country, has attained a level of economic growth without sub-sector linkage. Their results revealed that agriculture, industry, and services positively influence GDP. In fact, in the 18th century, Adam Smith perceived a significant relationship between increases in agricultural productivity and the wealth of nations. In this context, several studies, including those of Sen (1986); Sen (1989); Yamaguchi and Sanker (2006), and Anthony (2010) have focused on different countries, time periods, modeling techniques, and proxy variables used to determine the links between economic growth and agricultural outputs. In addition, the study by Mylene and John (1994) investigated the relationship between agricultural output growth, agricultural imports, and development assistance in a sample of 56 developing economies. Their result highlighted a long-run relationship between aid and agricultural imports, in which aid had a positive impact on agricultural growth. In the same context, Henneberry and Curry (2010) empirically investigated the import demand of 12 of the 15 largest agricultural import markets over the 1974-1990 period. They observed that domestic production is positively related to agricultural import volume in high-growth countries. They also concluded that agricultural exports lead to the economic growth of countries. Yamaguchi and Sanker (2006) examined the impact of a structural adjustment program on food imports and agricultural exports in Sri Lanka. They found that agricultural exports are positively related to the agriculture sector. In addition, they showed that the devaluation of currency reduces real food imports and increases agricultural exports. Recently, Oyinbo and Rekwot (2014) studied the relationship between economic growth, agricultural productivity, and inflation in Nigeria during the period 1970-2011. They found a one-way relationship between economic growth and the agricultural sector. In the same vein, Cervantes-Godoy and Dewbre (2010) pointed out that the agricultural sector is seen as an engine for economic growth and poverty reduction.

On the other hand, the impact of industrialization on economic growth has been widely studied. Since World War II, in the industrialization era, the main Asian economies, including Japan, the Republic of Korea, and the People's

Republic of China (PRC) have undergone remarkable economic changes (fast economic growth and major employment shifts from the agriculture sector to the manufacturing sector). During this period, the manufacturing sector has been an important engine of growth. This rapid industrialization has been sustained by high savings, investment rates, and export-oriented policies.

A large volume of empirical research from the last two decades has found that economic growth and manufacturing may be jointly determined (e.g. Szirmai, 2012; Verspagen, 1991) and has revealed that manufacturing acts as an engine of growth for low- and middle-income countries that have a sufficient level of human capital. The growth engine features are not found for the service output. For his part, Kaldor (1967) emphasized that industrial output plays a key role in economic growth as the potential productivity growth is the highest in this sector. With the right policies, the industrial output can improve the economy, which will transform a sluggish economic recovery into an economic resurgence. In fact, a study conducted by Rodrik (2009) showed that the transition to modern industrial activities acts as an engine for economic growth. Also, he noted that structural transformation is the sole explanation for accelerated growth in the developing world. On the other hand, Katuria and Raj (2009) examined the engine of growth at the regional level in India. Their results showed that industrialized regions grow more rapidly than other regions. Moreover, the economic literature has introduced a number of theories to explain the change in service output share and its effects on economic growth. In this context, Chenery, Robinson, Syrquin, and World Bank (1986) agreed with Clark (1941) who noted that there is a positive relationship between the share of services in GDP (or total employment) and GDP per capita. In his fundamental article, Baumol (1967) showed that higher productivity growth in the "progressive" (manufacturing) sector than in the "stagnant" (service) sector leads to shifts of labor from manufacturing to service industries. He added that aggregate output growth slows over time as the sector with a lower productivity growth expands.

In another study conducted in India, Thomas (2009), pointed out that services have been the prime mover of growth resurgence since the 1990s. Moreover, recent papers by Ngai and Pissarides (2007) and Acemoglu and Guerrieri (2008) have focused on the same subject, analyzing the multi-sector growth models developed by Baumol, which emphasized that the total factor productivity causes employment shifts to the "stagnant" (service) sector over the (non)-balanced growth path. In this context, several scholars (e.g Foellmi & Zweimüller, 2008; Kongsamut, Rebelo, & Xie, 2001) have relied on a demand-side explanation for structural change. More recently, Barry and Poonam (2012) noticed that GDP increases when the share of services in production and employment increases. They added that this increase is more significant when considering modern services, including post and communications, financial intermediation, computer, and business services.

2.2.2. How do Sectoral Outputs Influence the Environment?

Undoubtedly, agriculture, manufacturing, and services all have an environmental impact. In fact, one of a nation's major challenges is how to develop and adopt agricultural practices that produce the food needed to feed an increasing population and simultaneously sustain the environment in the long term. To this end, several studies have focused on the effect of agricultural practices on the environment (see, inter alia, Litterman, Onigbanio, & Soroka, 2003; Obioha, 2009; Ongley, 1996). In fact, Hawken, Lovins, and Lovins (1999) reported that moderate, severe, or extreme soil degradation has affected 1.2 billion hectares of agricultural land globally, 80% of which has taken place in developing countries. Moreover, Ongley (1996) pointed out that the main cause of pollution in Europe is agriculture. Along the same lines, Wassmann, Neue, Lantin, Buendia, and Rennenberg (2000) highlighted that much of the planet's methane (CH4) emissions are produced by livestock and continuously flooded rice paddies. Wang et al. (2000) estimated the total methane emissions from rice at between 10% and 15% of total global methane emissions.

Increasing concentrations of carbon dioxide lead to a partial closure of plant stomata (the small openings in plant leaves that control the flow of air). This phenomenon decreases evaporative cooling and can cause leaf temperature to exceed air temperature (Shafer, 2002). Tilman, Cassman, Matson, Naylor, and Polasky (2002) revealed that

delaying and reducing fertilizer application can reduce overall costs and pollution without harming yields. Moreover, studies conducted by Halicioglu (2009) and Mensah (2014) revealed an inverted U-shaped relationship between the growth of agricultural outputs and environmental pollution; however, agricultural activity is not the only cause of environmental pollution. In fact, industrial activities cause a lot of damage to the main constituents of the environment – land, air, and water – as well as living things. Moreover, industrial activities produce waste that contains harmful chemicals, particulates, and toxic heavy metals, which, when released into the air, can cause respiratory problems. Toxic chemicals and heavy metals accumulate in animal tissues and harm many living things along the food chain. Thus, environmental pollution is the contamination of the principal components of the environment, as well as the discharge of solid and hazardous waste. These various effects of industries directly impact humans and the environment (Ademoroti, 1996). Pandey (2005) reported that in the United States, industry is the main source of pollution as it accounts for more than half of all water pollution and most deadly pollutants. The same situation occurs in developing countries, where there is usually weak monitoring and enforcement. People consider industrialization to be the best and quickest form of development but, at the same time, industrialization has a negative impact. In fact, developing countries are increasingly concerned with the growing pollution levels in cities. In this context, governmental and environmental organizations around the world are concerned with environmental issues and pressure industries to reduce their pollutant emissions.

Dasgupta, Lucas, and Wheeler (2000) suggested that the sectoral composition of industry is a principal determinant of environmental quality; some industrial processes are much dirtier or more emission-intensive than others. Hettige, Mani, and Wheeler (1998) emphasized that industrial processes differ significantly in their production of waste residuals, which, in turn, have a varying potential for environmental damage.

Researchers such as Costantini, Mazzanti, and Montini (2013); Wang, Kang, Wu, and Xiao (2013) revealed that there is no relationship between sectoral outputs and environmental degradation. More recently, Omri (2018) examined the relationship between sectoral outputs (service, industrial, agricultural) and environmental degradation for 69 countries over the period 2001 to 2011 and concluded that the impact of sectoral outputs on environmental degradation is positive.

Additionally, the service sector contributes to environmental pollution. Al-Amin, Siwar, Jaafar, Mazumder, and Hossain (2007) showed via a quantitative assessment that selected air emissions of the service sector in Malaysia increased during the 1991-2000 period. Their finding highlighted that the contribution of the transport & communication, trade, finance-related service, public service, and entertainment sectors to economic growth is almost steady; yet the CO, CO2, SO2, and NOx emissions from the selected sectors are substantial. Similarly, Rosenblum and Hendrickson (2000) noted that, given their large share of the GDP in the US, services have become an important component of overall emissions, waste, and energy consumption. They also emphasized that the service industries have significant indirect environmental effects on an economy-wide basis, even when their direct emissions are negligible. Furthermore, industrial pollution bears the greatest responsibillity for environmental degradation, which is one of the primary concerns of societies today.

2.2.3. How do Sectoral Outputs Influence Human Development?

Sectoral output is essential to human development since it creates dynamic and competitive economic forces that stimulate employment and income, encourage international trade, and ensure efficient use of resources. As such, it is a major driver of poverty alleviation and shared prosperity. However, this sector is only considered an economic opportunity.

Undoubtedly, agriculture is the principal activity that produces most of the world's food, fiber, materials for shelter, and in some systems, medicinal plants. As such, it is fundamental to good health and the continuity of people's lives. However, agriculture is connected with many of the world's major health problems, for example, under-nutrition, malaria, HIV/AIDS, foodborne diseases, diet-related chronic diseases, and a range of occupational health

hazards (Hawkes & Ruel, 2006). These authors pointed out that being an agricultural producer is a determinant of health through intermediary processes related to income and labor. In short, agriculture affects the income earned by people who make their living from the land. The amount, type, stability, and control of producers' income influence their ability to purchase and access food, water, land, and health-related services.

Focusing on the role of agriculture in poverty reduction, Delgado et al. (1998) revealed that the agricultural sector has shifted its focus from fostering economic growth to maximizing poverty reduction or achieving 'shared' growth. Growth with maximum benefits leads to poverty reduction. In similar studies, Mellor (1976) and Timmer (2005) stressed the role of agricultural productivity in development. They agree that agricultural productivity growth is central to sustainable economic development. On the other hand, with the fourth industrial revolution, we are facing a profound change to our way of life. In fact, the benefits of the industrial revolution are characterized by a fusion of technologies across physical, digital, and biological domains. Moreover, they can bring a fundamental change in an unprecedented non-linear way. These scientific and technological advances improve health services. Recently, Compagnucci, Fenwick, Haapio, Minssen, and Vermeulen (2020) emphasized that medical and technological breakthroughs and advances will make health and healthcare much more connected, precise, and democratized, with significantly improved human outcomes. However, in line with this reasoning, industrial innovations inevitably carry risks and raise important questions. The rising healthcare spending and the unaffordability of treatments are already a global challenge; there are concerns that expensive new treatments and technologies will only exacerbate these trends, and technology may deepen global healthcare inequalities.

According to Ling and Issac (1996), industrial effluents from industrial firms' operations have adverse effects on human health, the natural environment, and socio-economic aspects. In this context, Bianchi, Booij, and Tscharntke (2006) and Schmitz and Nadvi (1999) pointed out that there is a global need for industrial transformation, especially in developing countries where poverty, unemployment, and inequality remain significant. However, Agu and Evoh (2011) noted that manufacturing output is expensive and causes a lot of air and sound pollution for both companies and individuals, which threatens people's health.

Studies have shown the role of service output in improving people's living conditions. For example, Shepherd and Pasadilla (2011) stated that many services, such as basic human services, produce outputs that are important to human development. Moreover, other services are important inputs in the production and distribution of goods that are necessary for human development purposes. Furthermore, a service sector is considered profitable when these goods and services can be made available to the poor more broadly and cost-effectively. These authors argue that less restrictive service trade policies have recorded better human development outcomes across a range of sectors. Therefore, appropriate service trade liberalization can stimulate human development not only directly, through improved outcomes, but also indirectly, through the income channel. Other studies (e.g Arvis, Mustra, Ojala, Saslavsky, & Shepherd, 2010; Eschenbach & Hoekman, 2006; Findlay & Warren, 2000) have shown that a more restrictive service environment is associated with less efficient and lower-quality service provision, inefficient resource allocation, and slower economic development.

Bjørnskov, Dreher, and Fischer (2008) pointed out that a less limited policy environment in the distribution sector can lead to a more efficient and less costly service provision, as well as to wider availability of important human development products, such as vaccines.

Moreover, it has long been recognized that education services have an obvious link with human development. In this context, Benhabib and Spiegel (1994) revealed that liberal policies can improve the availability of education services and increase students' access to them. An environment that is favorable for the educational service stimulates adult literacy and enrolment rates. In fact, greater access to education services can also indirectly improve life expectancy, not only through a better knowledge of hygiene but also, possibly, because of the greater empowerment that results from the ability to better use individual talents and abilities.

3. MATERIALS AND METHODOLOGY

3.1. Econometric Modeling

In this paper, we examine the contribution of entrepreneurship and sectoral outputs to three dimensions of sustainable development for 21 developed countries, namely Austria, Australia, Belgium, Finland, France, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom. The data were obtained from the World Development Indicators, the Global Entrepreneurship Monitor (GEM), and the United Nations Education, Science and Culture Organization (UNESCO). This implies that entrepreneurship and sectoral outputs are endogenous variables. As mentioned above, most of the existing literature has found that these endogenous variables are likely to lead to changes in sustainable development dimensions. Therefore, the interrelationships between these two variables and sustainable development dimensions are worth investigating by considering them separately in a modeling framework. The aggregate production function is used to examine the interrelationships between the variables. For this purpose, we employ the Cobb–Douglas production function, counting capital and labor as additional factors of production. There are very serious concerns about entrepreneurship and sustainability (Ben, Boubaker, & Omri, 2018; Cohen & Winn, 2007; York & Venkataraman, 2010) but there is no shared consensus on this relationship. However, not much attention has been paid to the relationship between sectoral production and sustainable development. Therefore, our study aims to fill this gap.

Consequently, our proposed model, which is consistent with the broader literature cited above on the effects of entrepreneurship and sectoral production on sustainable development, takes the following form:

$$\gamma = e^{\varepsilon} AK^{\alpha} E^{\lambda} L^{\beta} \quad (1)$$

In our model, we allow technology to be endogenously determined by entrepreneurship and sectoral production within an augmented Cobb–Douglas production function, as per Dritsaki and Stamatiou (2018). The literature has shown that entrepreneurship and sectoral production have different impacts on sustainable development pillars. Therefore, we have:

$$A(t) = \theta\ (EP)^{\alpha}\ (SO)^{\beta} \quad (2)$$

Where θ is a time-invariant constant, EP and SO denote entrepreneurship and sectoral production, respectively. SO is determined by the agriculture (YA), industrial (YI), and service (YS) sectors. Then, we substitute Equation 1 into Equation 2 as follows:

$$Y = \theta\ EP(t)^{\lambda_1}\ SO(t)^{\lambda_2} EC(t)^{\lambda_3}\ K(t)^{\alpha} L(t)^{1-\alpha}\ e^{\varepsilon} \quad (3)$$

In Equation 1, we divide both sides of the equation by population to obtain all series in per capita terms. By taking the log, the linearized production function can be written as follows:

$$\log Y_t = \alpha_0 + \alpha_1 logEP_t + \alpha_2 logYA_t + \alpha_3 logYI_t + \alpha_4 logYS_t + \alpha_5 logEC_t + \alpha_6 logK_t + \varepsilon_t \quad (4)$$

It should be noted that SO is represented here by the three sectors (YA, YI, and YS) as mentioned above. Then, we write Equation 4 in a growth form with a time series specification as follows:

$$g(Y)_{it} = \alpha_0 + \alpha_{1i}\, g(EP)_{it} + \alpha_{2i}\, g(YA)_{it} + \alpha_{3i}\, g(YI)_{it} + \alpha_{4i}\, g(YS)_{it} + \alpha_{5i}\, g(EC)_{it} + \alpha_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (5)$$

where subscript = 1, … , N denotes the country (= 21 in our study) and t = 1, … , T denotes the time period, g(Y) represents the growth rate of per capita GDP, g(K) the source of the growth rate of capital stock, g(EP) the entrepreneurial activity, g(YA) the real added value of agriculture, g(YI) the real added value of industry, g(YS) the real added value of services, and g(EC) the source of the growth rate of per capita energy consumption. Moreover, the returns to scale are involved in the entrepreneurial activity while the real added values of agriculture, industry, services, energy consumption, and capital stock are shown by α_1 α_2 α_3 α_4 α_5 and α_6, respectively.

Next, we use the production function in Equation 5 to derive the empirical models to separately study the contribution of entrepreneurship and sectoral production to economic growth g(GDP), environmental quality g(E), and human development g(HDI). These models are also inspired by the previous theoretical and empirical literature

and help analyze the linkages between our variables of interest. The three functions that determine the role of entrepreneurship and sectoral production in the three pillars of sustainable development are the following:

$$g(GDP)_{it} = \alpha_0 + \alpha_{1i}\, g(EP)_{it} + \alpha_{2i}\, g(YA)_{it} + \alpha_{3i}\, g(YI)_{it} + \alpha_{4i}\, g(YS)_{it} + \alpha_{5i}\, g(EC)_{it} + \alpha_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (6)$$

$$g(E)_{it} = \beta_0 + \beta_{1i}\, g(EP)_{it} + \beta_{2i}\, g(YA)_{it} + \beta_{3i}\, g(YI)_{it} + \beta_{4i}\, g(YS)_{it} + \beta_{5i}\, g(EC)_{it} + \beta_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (7)$$

$$g(IDH)_{it} = \lambda_0 + \lambda_{1i}\, g(EP)_{it} + \lambda_{2i}\, g(YA)_{it} + \lambda_{3i}\, g(YI)_{it} + \lambda_{4i}\, g(YS)_{it} + \lambda_{5i}\, g(EC)_{it} + \lambda_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (8)$$

In Equation 6, α1, α2, α3, α4, α5 and α6 suggest that entrepreneurial activity and real added value of agriculture, industry, services, energy consumption, and capital stock are the key factors of economic growth (see e.g Abdouli & Hammami, 2017; Ben et al., 2018; Henneberry & Curry, 1995; Szirmai, 2012). In Equation 7, β1, β2, β3, β4, β5 and β6 postulate the effect of entrepreneurial activity and the real added values of agriculture, industry, services, energy consumption, and capital stock on CO2 emissions (e.g Ben et al., 2018; Mensah, 2014; Ongley, 1996; Saidi & Hammami, 2015). In Equation 8, λ1 λ2, λ3 λ4 λ5 and λ6 state that entrepreneurial activity and the real added values of industry, services, energy consumption, and capital stock can influence human development (e.g Almeida et al., 2013; Hawkes & Ruel, 2006; Lozano et al., 2013; Shepherd & Pasadilla, 2011).

3.2. Data Source and Descriptive Statistics

The present study uses annual data for the period 2001-2016 for 21 developed countries, namely Austria, Australia, Belgium, Finland, France, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom. The data are obtained from the World Development Indicators, the World Bank Indicators, the Global Entrepreneurship Monitor (GEM), and the United Nations Education, Science and Culture Organization (UNESCO). The variables used in our study are defined in the Appendix.

The descriptive statistics of these variables, i.e., the standard deviation (Std. Dev.), the minimum and maximum values, and the coefficient of the variation (CV) are recorded below in Table 1.

The minimum and maximum values indicate the existence of possible outliers that help calculate the coefficients of variation for each variable (standard deviation/average) to check the heterogeneity/homogeneity of the sample according to the variable being studied.

As an example, the coefficient of variation of the GDP variable is 0.046 <0.15, which indicates the homogeneity of the sample with regard to GDP. Similarly, Ln HDI (0.04 <0.15) LnYA (0.07 <0.15), LnYI (0.04 <0.15), LnYS (0.04 <0.15), and LnK (0.09 <0.15) showed that the samples are homogeneous with regard to the variables HDI, YA, YI, YS, and K, respectively. In contrast, LnRE (0.98> 0.15), LnEP (0.20> 0.15), and LnE (0.18> 0.15) indicate the heterogeneity of the sample with regard to capital stock, energy consumption, and entrepreneurship, respectively.

Table 1. Descriptive statistics.

Vbls	Mean	Std-Dev	Min.	Max.	Coef-Var
LnGDP	10.47109	0.5886562	8.513426	11.68877	0.046
LnE	2.109805	0.3949803	1.324963	3.211837	0.18
LnHDI	25.69065	1.188188	22.564424	28.34217	0.04
LnEP	6.131805	1.23463	3.330604	9.246095	0.20
LnYA	22.61102	1.618132	17.90283	24.98352	0.07
LnYI	25.48095	1.223659	21.97067	28.13738	0.04
LnYS	26.44257	1.200947	23.46352	29.12181	0.04
LnEC	15.74429	15.4306	0.4692615	59.6064	0.98
LnK	4.603231	0.4277356	-2.556819	5.272293	0.09

Note: Std dev. and CV indicate standard deviation and coefficients of variation (standard deviation-to-mean ratio), respectively.

Table 2 reports the results of Pesaran (2006) between all the panel series of the explanatory variables. The correlation between entrepreneurship and capital stock is positive. On the other hand, entrepreneurship is negatively correlated with energy consumption and agricultural, industrial, and service outputs. Energy consumption is positively correlated with capital but negatively correlated with agricultural outputs, industrial outputs, and service outputs. Also, there is a negative correlation between capital and the three output sectors, while industrial outputs are positively correlated with agricultural and service outputs. However, the relationship between agricultural and service outputs is negative.

Table 2. Correlation matrix.

Vbls	LnEP	LnEC	LnK	LnYS	LnYA	LnYI
LnEP	1					
LnEC	-0.128	1				
LnK	0.337	0.140	1			
LnYS	-0.080	-0.262	-0.045	1		
LnYA	-0.177	-0.024	-0.140	-0.232	1	
LnYI	-0.297	-0.146	-0.305	0.440	0.084	1

4. RESULTS AND DISCUSSION

4.1. Panel Unit Root Tests

We start our investigation by conducting panel unit root tests. In a panel data analysis, several tests, such as those of Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003), are used to determine the stationary variables. According to these tests, the null hypothesis implies that there is a unit root (i.e. the variables are non-stationary), whereas the alternative hypothesis states that no unit root exists in the series (i.e. the variables are stationary). However, Pesaran (2007) was the first to propose a unit root test on panel data, which relaxes the constraint imposed by Levin and Lin (1992) and Levin and Lin (1993) on the homogeneity of the autoregressive root. Thus, in our study, we use Pesaran's (2007) test, which is based on the famous augmented Dickey-Fuller regression. Table 3 shows that all the series are not stationary in level. Hence, all variables are integrated in order I(1).

Table 3. Results of the panel unit root test (Pesaran, 2007).

Vbls	In level	1st difference
LnGDP	-2.37	-3.39**
LnE	-2.46	-3.43**
LnHDI	-2.41	-2.62***
LnEC	-1.60	-3.08**
LnK	-2.46	-3.40**
LnEP	-2.42	-3.74**
LnYA	-1.31	-2.75 **
LnYS	-1.45	-3.93**
LnYI	-1.33	-3.66**

Note: Critical value -2.67 (5%); **, and *** indicate a correlation significance at a 5% and 10% level, respectively.

4.2. Panel Cointegration Test: Pedroni (1999); Pedroni (2004)

The co-integration between the variables of our study is presented in Table 4. ADF and PP statistical tests are significant and integrated. According to the results of the within-dimension and between-dimension statistics, the variables in our panels are co-integrated. Therefore, we reject the null hypothesis of the absence of cointegration. This indicates the existence of a long-term cointegration relationship between the variables.

4.3. The FMOLS Estimation

After checking the stationary and long-run co-integration of the used variables, we estimate the three long-run relationships. First, between entrepreneurship, sectoral outputs, and economic growth. Then, between

entrepreneurship, sectoral outputs, and CO2 emissions. Finally, between entrepreneurship, sectoral outputs, and the Human Development Index of the developed countries' panel using the panel method FMOLS while the other variables were used as instrumental. The empirical results of Equations 6, 7, and 8 obtained from this method are depicted in Table 5.

Table 4. Pedroni's panel cointegration test.

	Within-dimension		Weighted		Between	
	Economic Dimension					
	Statistic	prop	Statistic	prop	Statistic	prop
Panel v-Statistic	14.99549	0.0000	-0.320606	0.6257		
Panel rho-Statistic	5.728762	1.0000	6.925700	1.0000		
Panel PP-Statistic	-2.771202	0.0028	-3.749167	0.0001		
Panel ADF-Statistic	-2.053955	0.0200	-2.610014	0.0045		
Group rho-Statistic					7.989948	1.0000
Group PP-Statistic					-13.67676	0.0000
Group ADF-Statistic					-2.319728	0.0102
Environmental Dimension						
Panel v-Statistic	-2.637417	0.9958	-3.523909	0.9998		
Panel rho-Statistic	6.455872	1.0000	4.285745	1.0000		
Panel PP-Statistic	-5.776348	0.0000	-9.424765	0.0000		
Panel ADF-Statistic	-6.514145	0.0000	2.425477	0.0076		
Group rho-Statistic					6.487570	1.0000
Group PP-Statistic					-16.23969	0.0000
Group ADF-Statistic					-1.406859	0.0797
Social Dimension						
Panel v-Statistic	-2.012865	0.9779	-4.051322	1.0000		
Panel rho-Statistic	6.298123	1.0000	6.029716	1.0000		
Panel PP-Statistic	-6.514313	0.0000	-11.54444	0.0000		
Panel ADF-Statistic	-5.139869	0.0000	-5.076482	0.0000		
Group rho-Statistic					7.280466	1.0000
Group PP-Statistic					-19.77057	0.0000
Group ADF-Statistic					-7.167293	0.0000

The empirical results of Equation 6, which analyzes the economic effect of entrepreneurship and sectoral outputs on economic growth, showed that entrepreneurship has a positive and significant impact on the per capita GDP of the countries in our study. This implies that economic growth is elastic with entrepreneurship as a 5% increase in entrepreneurship raises economic growth by 0.029%. This result is consistent with the findings of Habbershon, Nordqvist, and Zellweger (2010) in the European context and Ben et al. (2018) for 17 African countries. The same table shows that industrial outputs make the greatest contribution to economic growth followed by service and agricultural outputs. The magnitudes are 0.298, 0.142, and 0.117, which implies that a 5% rise in industrial, service, and agricultural outputs increases economic growth in developed countries by 0.3%, 0.14%, and 0.12%, respectively. These results mean that in developed countries, the sectoral outputs positively contribute to economic growth, which confirms, for example, the results of Isiksal and Chimezie (2016). Moreover, capital stock and energy consumption showed a positive and statistically significant effect on economic growth at the level of 1% and 5%, respectively. The coefficient magnitudes of 0.090 and 0.541 imply that a 1% and 5% increase in capital stock and consumption of energy, respectively, lead to an increase in per capita GDP of 0.9% and 0.54%, respectively. Therefore, an increase in capital and energy leads to an increase in economic growth. These results are in line with the observations of Abdouli and Hammami (2017) for the MENA countries. Table 5 also shows the factors affecting the environmental quality (environment dimension) of 21 developing countries using the panel FMOLS estimation. It reveals some interesting results. It appears that environmental degradation is a positive function of entrepreneurship, the three sectoral outputs, and energy consumption. In fact, the effect of entrepreneurial activity on environmental degradation is

positive and statistically significant for all countries. This suggests that environmental quality is elastic with respect to entrepreneurship, and a 1% increase in entrepreneurship increases CO2 emissions by 0.083%. These results are consistent with the findings of Omri (2013) but contradict those of Cohen and Winn (2007); Hall et al. (2010) and York and Venkataraman (2010). Besides, Hall et al. (2010) noted that entrepreneurship could provide a solution to various social and environmental problems.

On the other hand, the magnitudes of 0.189 and 0.472 suggest that a 1% rise in agricultural and service outputs increases environmental degradation by 0.19% and 0.47%, respectively; also, a 10% increase in the industrial output increases CO2 emission by around 0.084%. These results confirm those of Omri (2013); Apergis and Payne (2014). In addition, energy consumption has a positive and significant impact on CO2 emissions. This implies that a 1% increase in energy consumption increases CO2 emissions by around 0.35%. This result is consistent with the findings of Apergis and Payne (2014), for a panel of seven Central American countries, and Ben and Ben Youssef (2015), for a group of North African countries. Finally, capital stock has an insignificant negative impact on CO2 emissions.

According to the results from Equation 8 presented in Table 5, it is clear that all the dependent variables except energy consumption have a positive and statistically significant impact on the human development index. Besides, the reported coefficients of entrepreneurship, sectoral outputs (YA, YS, and YI), and capital stock are statistically significant at 1%, 5%, and 10% levels. This implies that all these variables promote human development.

The coefficient of the entrepreneurial activity is 0.372, implying that a 5% increase in entrepreneurship increases human development by 0.372% for our sample countries. This result reveals the key role of entrepreneurial activity in achieving the objectives of the third dimension of sustainable development. This result is similar to the findings of Silvestre (2015), who highlighted the important role played by entrepreneurial activity in the use of more sustainable products and services. Moreover, the coefficient of the agricultural output indicates that the agricultural sector has a significant and positive effect on human development at the 1% level. In fact, a 1% increase in agricultural output stimulates human development by 0.605%. This finding supports those of Delgado et al. (1998); Hawkes and Ruel (2006); Delgado et al. (1998), who demonstrated the fundamental role of agriculture in maximizing poverty reduction and achieving 'shared' growth. Similarly, Hawkes and Ruel (2006) argued that agriculture is essential for good health as it supplies the world's food, fiber, materials for shelter, and, in some systems, medicinal plants.

Table 5. Results of panel FMOLS estimation for Eq. (6), Eq. (7), and Eq. (8).

Dimensions	Independent variables	Coefficient	Probability
Economic dimension	Dependent variable: Economic growth (GDP)		
	LnEP	0.029**	(0.025)
	LnYA	0.117**	(0.010)
	LnYS	0.148**	(0.032)
	LnYI	0.298**	(0.013)
	LnK	0.090*	(0.003)
	LnRE	0. 541**	(0.013)
Environmental dimension	Dependent variable: CO2 emissions (E)		
	LnEP	0.083*	(0.003)
	LnYA	0.189*	(0.000)
	LnYS	0.472*	(0.007)
	LnYI	0.0838***	(0.052)
	LnK	-0.013	(0.642)
	LnRE	0.348*	(0.024)
Social dimension	Dependent variable: Human development (HDI)		
	LnEP	0.372**	(0.049)
	LnYA	0. 605*	(0.000)
	LnYS	0.079**	(0.014)
	LnYI	0. 348***	(0.067)
	LnK	0.337*	(0.000)
	lnRE	0.001	(0.870)

Notes: P-values are reported in parentheses. *,**, *** indicate significance at 1%, 5%, and 10%, respectively.

For the panel estimation, the service output variable has a significant and positive effect on human development at the 5% level. This suggests that a 5% increase in services output raises human development by around 0.08%. This result is in line with those of Eschenbach and Hoekman (2006) for transition economies and Arvis et al. (2010) for high-income countries. The FMOLS estimator results also showed that, at the 10% level, industry output positively and significantly affects human development. The magnitude of 0.348 indicates that a 10% increase in industrial production increases human development by around 0.35%. This means that industrial output plays an essential role in the improvement of social welfare and confirms the results of Bianchi et al. (2006) and Schmitz and Nadvi (1999) in the context of developing countries. Moreover, we find that a 1% increase in capital stock increases human development by around 0.34%. In fact, capital stock constitutes an important channel for the improvement of living conditions and the achievement of social objectives of sustainable development (Knight, 1996; Lau, Dean, & Frederic, 1991). Finally, the energy consumption variable has an insignificant impact on human development.

5. CONCLUSIONS AND POLICY AND RESEARCH RECOMMENDATIONS

Although the literature on sustainable development has increased over the last few years, there has been little research on the contribution of entrepreneurship and sectoral outputs. What is more, studies have not linked these factors with the three pillars of sustainability. Similarly, the literature on this subject has neglected the importance of entrepreneurial activity and sectoral outputs to human development and environmental quality. Additionally, most previous studies have tried to determine the relationship between these factors and economic growth. Our study sets itself apart by studying the effect of entrepreneurship and sectoral outputs not only on economic growth, the first dimension of sustainable development, but also on the two other dimensions: environmental and social sustainability.

Our main findings are as follows. First, for economic sustainability, we found that entrepreneurship and sectoral outputs positively contribute to economic growth. Second, for environmental sustainability, our study revealed that entrepreneurship and the real value added of agriculture, industry, and services increase CO2 emissions for the panel of our analysis. Moreover, for the third sustainable development pillar, social sustainability, our work showed a positive relationship between entrepreneurship and the determinants of sectoral outputs in the case of developed countries. We can conclude that entrepreneurship and sectoral outputs are important as they help improve standards of living and create wealth besides. They have been recognized as solutions for overcoming future problems such as climate change, not only for entrepreneurs but also for related businesses as they help drive change through innovation, where new and improved products can lead to the development of new markets.

Given this perspective, our research analyzes the contribution of sectoral outputs in achieving sustainability goals. More precisely, our study attempts to clarify the fundamental role of entrepreneurship and sectoral outputs in the move toward a healthier, more sustainable future in developed countries. Using the FMOLS estimator, we examined the influence of entrepreneurship and sectoral outputs on the three pillars of sustainable development: *economic efficiency* "reflection of sound and sustainable management, working for economic growth", *environmental quality* "preservation of natural resources in the long term", and *social equity* "to meet the basic needs of people", by studying 21 developed countries over the 2001-2016 period.

Our empirical results offer important conclusions concerning the sustainability approach, which have important policy implications. We found that in developing countries, entrepreneurship contributes to economic growth and the improvement of social objectives. However, they increase environmental pollution. Besides, they have various explanations. The positive effect of entrepreneurship on economic growth means that entrepreneurship activity can support economic growth in the countries of our study, which implies that our results confirm the ideas of the neoclassical theory, mainly those of Marshall, which assume that entrepreneurship is always linked with profit. Entrepreneurship, therefore, plays a special role in shaping the landscape of a country's economy, a fact recognized by economists and policymakers. In fact, entrepreneurial activity has never been an imitator but is only an innovator of how to stimulate the monopolist. Since economic progress comes from innovation, a monopoly innovator should

be protected, and entrepreneurship should be encouraged so that productivity and the diversification of products and services will be protected. Globally, the countries concerned can resist competition.

On the other hand, the positive link between human development and entrepreneurship implies that an increase in entrepreneurship promotes life quality in terms of poverty, education, and health. Although education is a direct or indirect driving force of every country's economy, entrepreneurship can play a significant role in the improvement of advanced skills and innovative thinking to work through the modern challenges in the workplace. In fact, entrepreneurship not only involves the idea of starting a company but also leads to creative and ambitious thought. Therefore, the developed countries of our sample must take advantage of the positive effects of entrepreneurship because it creates opportunities, ensures social justice, instills confidence, and stimulates the economy. In addition, they should encourage young people to develop their initiatives and help them to be more inventive and self-confident in whatever they undertake, as well as acting in a socially responsible way.

In the health sector, entrepreneurship, as a process that can help produce new ventures from new or existing concepts, ideas, and visions, can improve the sanitary conditions in the countries of our sample. In fact, a strong healthcare sector is necessary to ensure that the citizens of a country are healthy and can contribute to the country;s economic growth. Moreover, entrepreneurship ensures the effective delivery of services and the fruitfulness of operations, which leads to patient satisfaction. It can also introduce new ideas that help reduce costs in hospitals.

In order to keep their patients, healthcare providers must pay attention to what is best for their patients' health. They must implement practices that seek to resolve health problems and always consider the health of patients in their decision-making. On the other hand, unethical practices by healthcare providers are very distressing and displeasing and often result in comprising the safety and wellbeing of the patient. In this context, entrepreneurship can create an environment that promotes the application of good practices.

While our results indicate that entrepreneurship is important in achieving the economic and social pillars of sustainability, they also highlight that entrepreneurship is harming the environment. These latest results contradict those of Shepherd and Patzelt (2011), who argued that entrepreneurship can protect ecosystems, improve environmental quality, reduce deforestation, and increase freshwater supplies in some developed countries. Therefore, these countries must be careful in this context; they must orient the spirit of enterprise and innovation towards services that help protect the environment. Also, they must encourage young entrepreneurs in their efforts to find solutions to these problems. Such efforts might serve to decrease environmental pollution.

Furthermore, our study has revealed a positive link between sectoral outputs and economic growth, on the one hand, and between the environment and human development on the other. Therefore, these results show that sectoral outputs stimulate economic growth and social welfare but can cause environmental degradation in the studied countries. This implies that these countries' policymakers should implement more prudent policies. These policies should favor improved working conditions in the agricultural, service, and industrial sectors to ensure economic growth and human development. Nevertheless, they should bear the environment in mind by requiring production methods that do not threaten environmental safety. Indeed, sustainability objectives cannot be achieved without considering the role of economic sectors because they are the main components of the economy. Moreover, sustainable development is ensured by the performance of the economic sector, which could lead to structural change resulting in an efficient reallocation of labor across the economic sectors.

Given this context, our results lead us to recommend serious policy changes to improve the environmental situation worldwide. First, despite their developed status, the environmental conservation efforts undertaken by these countries are insufficient. To maintain their economic prosperity, these countries must employ more resources and logistics to diminish CO_2 emissions resulting from energy use, that is to say, from fossil fuels. Consequently, these countries should resort to cleaner fossil fuel resources, such as natural gas and higher-grade coal, and use clean energy types, such as hydro, solar, geothermal, and wind energy. In fact, they must start to think about more advanced technologies that will guarantee both their wealth and their welfare. While sustainable development is determined

by competing and evolving visualizations of how to adequately balance the three policy pillars, it certainly requires systemic modifications to socio-economic relationships and their influence on the environment. Moreover, balancing the need for environmental protection, economic well-being, and social equity across an appropriate and integrated approach through diverse institutions at different levels is the fundamental challenge of achieving sustainability. In fact, sustainable development requires the promotion of values that stimulate consumption standards within ecological limits to which all can fairly aspire. More specifically, sustainable development that focuses on social, economic, and environmental concerns further increases the difficulty of the interaction between these different goals. This suggests the need for cooperation between the various actors to pursue these remarkably evolving goals.

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Appendix. Definitions of the variables.

Variables	Definitions
Gross Domestic Product (GDP)	Since the 1930s, GDP has been the most widely used measure of national growth worldwide (Lippman, 2009). In fact, real GDP is essential in accurately measuring productivity, which is essentially an output (real GDP) divided by inputs (Dynan & Sheiner, 2018). Moreover, it is the most closely watched aggregate economic indicator and is often used as a measure of a country's production. The data collected from the World Bank Indicators are in constant U.S. dollars.
CO2 emissions	CO2 emissions are the release of carbon dioxide into the atmosphere. This indicator is used as a measure of environmental quality. The data, which are collected from World Bank Indicators, are in metric tons.
Human Development Index (HDI)	HDI is an indicator designed to track the development of countries in three dimensions: health, education, and income. Thus, the HDI is calculated using a simple average of the three indices: education, life expectancy (a proxy for health), and GDP (a proxy for national income) (Salas-Bourgoin, 2014). The World Development Indicators and UNESCO's datasets are the sources of our data for these indices. The average of each of the three indices is calculated as follows (Human Development Report, 1990): $$Dimension\ index = \frac{Actual\ value - Minimum\ value}{Maximum\ value - Minimum\ value}$$
GDP index	GDP index is calculated using GDP per capita (constant US$)
Life expectancy index	This measures the average number of years a newly born infant is expected to live. We use 85 years as a maximum value and 20 as a minimum value (Human Development Report, 2010). We use the World Bank Indicators.
Education index	This is composed of two-thirds of the average duration of schooling for adults and a third of the expected duration of schooling for school-aged children [2/3 adult literacy rate + 1/3 school enrollment (primary, secondary and tertiary)] (Human Development Report., 2010). We use the World Bank Indicators.
For each country of our sample, the HDI will be calculated as the simple arithmetic average of the three indexes previously analyzed (Sagar & Najam, 1998). Thus, HDI = 1/3 (GDP index + life expectancy index + education index).	
Entrepreneurial activity (EP)	This is measured using formal entrepreneurship. According to Klapper, Amit, Guillén, and Quesada (2007), formal entrepreneurship is defined as "any economic unit of the formal sector incorporated as a legal entity and registered in a public registry..." It is measured using the total number of newly registered businesses as a percentage of the working-age population (Groşanu, Boţa-Avram, Răchişan, Vesselinov, & Tiron-Tudor, 2015) (World Bank). This indicator is widely used in the academic literature when studying the effects of the various determinants of entrepreneurship (see, for instance, Dau and Cuervo-Cazurra (2014). The ratio of entrepreneurship is presented as follows: $$\text{Entrepreneurship} = \frac{\text{Number of newly registered \& unregistered business}}{\text{working population's age}}$$
Agricultural outputs (YA)	These are measured by per capita agricultural value added (Omri, 2018). Data are collected from the World Development Indicators.
Industrial outputs (YI)	These are measured by means of the per capita industry value added (Omri, 2018), which is calculated using data from the World Bank.
Service outputs (YS)	These are measured by means of the per capita service value added (Omri, 2018). We refer to the World Development Indicators as our data source.
Energy Consumption (EC)	This is measured using the consumption of primary energy, which is represented by energy forms before its transformation to other end-use fuels. Energy consumption in the residential sector represents an important part of the total demand (Rahman et al., 2017). The data are measured in metric tons of oil equivalent. The World Development Indicators are our data source for this variable.
Capital stock (K)	This is measured by the gross fixed capital formation (constant 2005 US$). Traditional growth theories focus on capital as a major factor of production (Stern & Cleveland, 2004). In fact, Bartleet and Gounder (2010) showed that capital stock plays a fundamental role in economic growth.