



The Impact of Entrepreneurship on Economic Growth: Do Human Capital and the Types of Entrepreneurship Matter?

Daniela Ribeiro Rodrigues

up201107612@fep.up.pt

Dissertation Proposal
Master in Management

Supervised by:

Aurora Amélia Castro Teixeira

January 2018

Abstract

Entrepreneurship is generally defined as the creation of new firms and according to literature, it is the process by which new enterprises are founded and become viable. Although considerable research has been devoted to the study of the impact of entrepreneurship on economic growth, fewer studies have analyzed the impact of the types (opportunity vs necessity) of entrepreneurship on economic growth. Moreover, the latter set of studies overlooked the relevance of human capital as intermediate factor in the relation between (types of) entrepreneurship and economic growth. Thus, the aim of the present study is fill in the gap and to assess the extent to which the indirect impact of (the types of entrepreneurship), via human capital, matters for countries' economic growth.

Key-words: Impact; Entrepreneurship; Human Capital; Economic Growth

Index of contents

Abstract	2
1. Introduction.....	1
2. The relation between (types of) entrepreneurship, human capital and economic growth: a literature review	3
2.1. Defining the key concepts.....	3
2.1.1 Entrepreneurship and types of entrepreneurship.....	3
2.1.2. Human capital	4
2.2. Entrepreneurship, human capital and economic growth: main theoretical mechanisms and hypotheses to be tested.....	4
2.2.1. The direct impact of entrepreneurship and types of entrepreneurship on economic growth	4
2.2.2. The direct and indirect impact of human capital on economic growth	8
2.2.3. Other determinants of economic growth.....	11
3. Methodological aspects.....	12
3.1. Main hypotheses and method of analysis.....	12
3.2. Econometric specification and selection of the estimation technique.....	13
3.3. Variable proxies, data collection and sources	15
4. Chronogram of the Work	19
References.....	20
Annex.....	26

1. Introduction

Entrepreneurship plays a progressively more important role throughout the world and it is seen as an important engine to obtain economic growth (Stam & van Stel, 2009; Urbano & Aparício, 2016). It promotes economic development by enabling the introduction of innovations, by fostering competition and change, and by increasing rivalry (Wong, Ho & Autio, 2005; Vivarelli 2013). The impact of entrepreneurship on economic development has placed considerable attention among years by recognized and distinguished authors (e.g., Carree & Thurik, 2003; Valliere & Peterson, 2009; Ferreira, Fayolle, Fernandes & Raposo, 2017).

Taking into account the importance of entrepreneurship and despite the well-known challenges and risk involved in the entrepreneurial process, governments increasingly deploy incentives and support programs to encourage and stimulate individuals to become entrepreneurs (McConnell, McFarland, & Common, 2011; Stephan, Uhlaner, & Stride, 2015).

There is no commonly accepted definition of entrepreneurship (Van Praag, 1999; Mahoney & Michael, 2004; Thurik & Wennekers, 2004; Reynolds, Camp, Bygrave, Autio & Hay 2005). It can be defined, in a strict sense, as the creation of new enterprises (Reynolds, 1999; Wong et al., 2005), more precisely, the process by which new firms are founded and become sustainable (Szirmai, Naudé, & Goedhuys 2011; Acs, Audretsch, Braunerhjelm, & Carlsson, 2012; Vivarelli, 2013) or, in a broader understanding, as the process by which people take advantage of a business and pursue opportunities (Szirmai et al., 2011).

Currently, some dispute exists on whether and which types of entrepreneurship (necessity vs opportunity) matters most for economic growth and development (Reynolds, Camp, Bygrave, Autio & Hay, 2002; Urbano & Aparicio, 2016). ‘Opportunity entrepreneurship’ occurs when individuals want to avail themselves of a unique market opportunity and it is related to innovative entrepreneurship; in contrast, ‘necessity entrepreneurship’ comes from market friction and it is commonly related to non-innovative firms (Reynolds et al., 2005; Urbano & Aparicio, 2016). Analyzing a panel with 43 (25 OECD and 18 non-OECD) countries over the period from 2002 to 2012, Urbano & Aparício (2016) evidenced that both opportunity and necessity entrepreneurship are significantly related

to high levels of economic growth; notwithstanding, the effect of necessity entrepreneurship is smaller than that of opportunity entrepreneurship. However, other studies related with the effect of necessity and opportunity as entrepreneurship drivers on economic growth (e.g., Wong et al., 2005; Zali, Faghih, Ghotbi, & Rajaie, 2013), indicate that relationships between necessity-driven entrepreneurship and business growth are insignificant or negative, while the relationship between opportunity-driven entrepreneurship and business is positive.

Although many specific studies related to entrepreneurship and economic growth have been made (see Carree & Thurik, 2003; Wong et al., 2005; Valliere & Peterson, 2009; Acs et al., 2012), no evidence seems to exist on how, over time, the type of entrepreneurship, intermediated by human capital, impact on a given country's economic growth. We content that the creation of new enterprises is not in itself sufficient for fostering economic growth; rather, it is necessary to invest in human capital in order to reap the benefits of entrepreneurship and, ultimately, create, maintain and ensure sustainable economic growth (Enayati, 2007; Acs et al., 2012; Čadil, Petkovová, & Blatná, 2014).

Using panel data econometric modelling, the present study aims to assess the direct and indirect (through human capital) impacts of (the types of) entrepreneurship on economic growth.

This dissertation proposal is organized as follows. In a first section, a comprehensive literature review is presented, including the definition of the entrepreneurship and types of entrepreneurship and human capital concepts. Then, we detail the determinants of economic growth and the study's main hypotheses. Section 3 briefly presents the methodology pursued and in Section 4 the dissertation's chronogram is presented.

2. The relation between (types of) entrepreneurship, human capital and economic growth: a literature review

2.1. Defining the key concepts

2.1.1 Entrepreneurship and types of entrepreneurship

According to literature, entrepreneurship is commonly defined as the creation of new businesses and the process by which new firms become sustainable (Reynolds, 1999; Wong et al., 2005; Valliere & Peterson, 2009; Braunerhjelm, Acs, Audretsch & Carlsson, 2010; Acs et al., 2012; Vivarelli, 2013). As result of new firms' formation, Urbano & Aparício (2016) state that entrepreneurship is the process of new jobs creation.

A broader definition of the term, lead us to also consider entrepreneurship as the discovery and exploration of opportunities and innovation through the development of new processes and products, new sources of supply and the profiteering of economic activities and new markets (Davidsson et al. 2006; Santarelli & Vivarelli 2007; Audretsch & Keilbach, 2008, Bosma & Levie 2010; Braunerhjelm et al., 2010; Ferreira et al., 2017).

Distinguished authors presented in their studies two different types of entrepreneurship: the opportunity and necessity entrepreneurship (Carree & Thurik, 2003; Reynolds et al., 2005; Zali et al., 2013; Urbano & Aparicio, 2016; Ferreira et al., 2017). Necessity entrepreneurship occurs when individuals set up a business because they have limited options for work. This type of entrepreneurship is generally associated to non-innovative firms and results from market friction (Urbano & Aparicio, 2016). In contrast, opportunity entrepreneurship occurs when adults set up a business or owning-managing a young firm that is motivated to pursue perceived business opportunities (Reynolds et al., 2005; Urbano & Aparicio, 2016; Ferreira et al., 2017). Differently to necessity entrepreneurship, opportunity entrepreneurship is usually related to innovative firms (Urbano & Aparicio, 2016) being driven by pull motivations (Zali et al., 2013). According to Carree & Thurik (2003), the opportunity entrepreneur is an innovator that create entrepreneurial initiatives and, based on their knowledge, perceive a profit opportunity taking the risk that the venture may turn out to be a completely failure (Ferreira et al., 2017). On the other hand, necessity entrepreneurs tend to be more motivated by monetary rewards and driven by push motivations (Zali et al., 2013).

2.1.2. Human capital

"The most valuable of all capital is that invested in human beings."

(Alfred Marshall (1920), Principles of Economics)

Human capital reveals itself as a vague and somewhat complex concept that is referred to in the past and very distant years, and has been one of the most addressed issues in the current societies (Teixeira, 1999; Folloni & Vittadini, 2010).

The concept of human capital emerged in the 1960s, created by Theodore W. Schultz and it was developed and popularized by Gary Becker. For Schultz (1961), human capital is an indispensable asset for economic growth in organizations. It is composed by characteristics of the human being namely, their productive capacities that can result from the education/training they have acquired. Human capital is the set of skills, knowledge, attitudes and experiences, present in people that make up the organization and that in association, allows to provide a competitive differential, through creativity, innovation, motivation and resolution of possible conflicts (Bontis, 1998; Schultz, 1961). Also, according to Becker (1962), human capital should be understood as the skills that an individual acquires throughout his/her life, whose acquisition comes from experience, professional training, health and, above all, formal education.

Reinforcing the previous idea, Becker (1993) says that knowledge is implied in the characteristics and values of individuals. Therefore, education and training, in agreement with Schultz (1981), are the main sources of investment in human capital. Later, following Schultz's (1961) contributions, several authors showed later that human capital is a critical productivity engine and its accumulation is a requisite for economic growth (Benhabib & Spiegel, 1994; Enayati, 2007).

2.2. Entrepreneurship, human capital and economic growth: main theoretical mechanisms and hypotheses to be tested

2.2.1. The direct impact of entrepreneurship and types of entrepreneurship on economic growth

Entrepreneurship is important, especially in contemporary economies because it has high impact on their growth through innovation. (Carree & Thurik, 2003; Mrożewski & Kratzer, 2017).

The neo-classical theory identified the investment in labor and physical capital as driving forces of economic growth, however it does not expressly address the issue of entrepreneurship as a motif for technological innovation in a Schumpeterian context. (Solow, 1956, in Wong et al., 2005, Urbano & Aparicio, 2016). Besides, the endogenous growth theory, initially proposed by Romer (1990), underlined some aspects of entrepreneurship by highlighting that the process of invention and accumulation of knowledge is an additional critical driver to economic growth (Wong et al., 2005).

Schumpeter contributed for the study of entrepreneurship, when recovering the image of the entrepreneur in the economy as the main promoter of economic development, thanks to his/her innovation and ability to make new combinations of productive resources (Lambing & Kuehl, 2007, in Fontenele, 2010). He put forward the idea that entrepreneur is at the center of the process of economic growth. According to Schumpeter (1934), an entrepreneurial behavior should be used as a key point to drive economic development, since an entrepreneurial activity conducts to the process of creative destruction when being the cause of agitations that create opportunities for economic rent (Wong et al., 2005; Urbano & Aparício, 2016). Schumpeter's theory predicts that an increase in economic growth can be caused by an increase in the number of entrepreneurs (Schumpeter, 1942, in Wong et al. 2005). Schumpeterian type of models attributes special attention and recognition to innovation as a source of economic development (Wong et al., 2005). Recent studies in this line draw attention to entrepreneurship as a critical driver of economic growth and some of them included it as a production factor in the production function (Audretsch & Keilbach, 2004, in Stam & van Stel, 2009).

Considering the point of view of evolutionary economics, entrepreneurs give rise to new ideas to markets and energize growth through a process of competitive firm selection (Wong et al., 2005). Indeed, they facilitate the reallocation of resources from less to more productive uses by backing up structural changes (Wong et al., 2005).

Despite the above referred theoretical importance, entrepreneurship is a missing link in most empirical studies that aim to explain the drivers to economic growth. Schumpeter's theory have emerged as the basis for the subsequent empirical literature that has included the idea of innovation as the root of economic development (Wong et al., 2005, Urbano & Aparício, 2016, Ferreira et al., 2017).

Entrepreneurs are the ones who answer to chances, uncertainties, constraints, threats, and incentives coming from the economic area in which they operate (Szirmai et al., 2011).

This places entrepreneurship at the center of economic growth, development, and catching-up (Szirmai et al., 2011). Entrepreneurship also helps economic development by creating change, inserting innovations, creating competition and enhancing rivalry, which involves the exploitation of new products and processes, new sources of supply, the exploration of new markets and new ways to organize a business (Wong et al., 2005).

Several authors (e.g., Acs et al., 2012; Urbano & Aparício, 2016; Ferreira et al., 2017;) demonstrate that overall entrepreneurship is positively related to economic growth (see Table 1). According to Acs et al. (2012), when using ideas that in other ways might not be used and inserting them into the market through the creation of a new firm, entrepreneurship shows to positively influence the economic growth. Urbano & Aparício (2016) found that the overall total entrepreneurial activity (TEA) is higher in OECD countries than in non- OECD countries and it is higher in a post-crisis period than in a crisis period (Urbano & Aparício, 2016). Ferreira et al. (2017), considering Schumpeterian and Kirzenian approaches to entrepreneurship, reported that the overall entrepreneurship holds a statistically significant influence on the global competitiveness index (the proxy for economic growth). Valliere & Peterson (2009) evidence that high-expectation entrepreneurs are positively associated with growth in developed countries. In contrast, Wong et al. (2005) did not find support that high values of GDP growth rates are associated with high levels of overall entrepreneurship. However, they found that a high growth potential entrepreneurship impacts significantly the economic growth (Wong et al., 2005).

Taking the above into account, we conjecture that:

Hypothesis 1: Entrepreneurship affects positively countries' economic growth.

Entrepreneurship can be divided into two main sub-categories (Zali et al., 2013; Urbano & Aparicio, 2016; Ferreira et al., 2017): opportunity and necessity entrepreneurship. Wong et al. (2005) state that opportunity entrepreneurship is related to higher rates of growth because its rates demonstrate the existence of an economic rent that ideally arises from creating or implementing knowledge and technology. Additionally, and according to Audretsch et al. (2008, in Urbano & Aparicio, 2016), entrepreneurs take advantage of knowledge-based opportunities and thrive them into new products, which affect

positively on countries' economic performance. In this same line of reasoning, Reynolds et al. (2005) state that opportunity entrepreneurship is the result of individual decisions to chase entrepreneurial activities based on knowledge, and in this way is associated with innovation. Such innovation led perspective of opportunity entrepreneurship demonstrate the creation of technology and knowledge influencing positively economic growth (Valliere & Peterson, 2009; Urbano & Aparicio, 2016). To Ferreira et al. (2017) opportunity-based or Kirzerian entrepreneurship positively influences labour productivity growth, suggesting a positive relation between opportunity entrepreneurship and economic growth.

In the study of Mrożewski & Kratzer (2017), it was found that technological progress is highly positively influenced by opportunity entrepreneurship. In this case, we should give special attention to opportunity entrepreneurship as an important booster of innovation that leads to an increase on economic growth (Mrożewski & Kratzer, 2017).

Contrasting with the above evidence, Wong et al. (2005) when studying lower-income nations failed to encounter a significant relation between opportunity entrepreneurship and economic growth. Such absence can be explained, according to Wong et al. (2005), by the presence of economic rents derived from market imperfections.

Taking into account the theoretical and empirical contributions summarized above, we conjecture that:

Hypothesis 2a: Opportunity entrepreneurship affects positively countries' economic growth.

Regarding necessity entrepreneurship, Urbano & Aparicio (2016) reported that individuals who are motivated by the necessity due to back work conditions, such as unemployment, tend to own fewer endowments, most notably human capital and entrepreneurial capability. These authors found, nevertheless, that necessity entrepreneurship is positively related to economic growth, given its impact on employment. In contrast, Wong et al. (2005) did not found significant statistical relation between necessity entrepreneurship economic growth.

According to Mrożewski & Kratzer (2017), it was found that innovation is negatively related to a high share of necessity entrepreneurship. In this case, the authors found that economic development shows to be negatively influenced by necessity entrepreneurship (Mrożewski & Kratzer, 2017).

Albeit affecting positively economic growth, Urbano & Aparicio (2016) found that necessity entrepreneurship tends to reflect a lower value creation and thus produces smaller impact on economic growth when compared to opportunity entrepreneurship.

In this context, we conjecture that:

Hypothesis 2b: Necessity entrepreneurship affects positively countries' economic growth.
and

Hypothesis 2c: The impact of opportunity entrepreneurship on countries' economic growth is higher than that of necessity entrepreneurship.

2.2.2. The direct and indirect impact of human capital on economic growth

Several authors (e.g., Barro, 1991; Mankiw et al., 1992; Hanushek & Woessmann, 2008; Hanushek 2013) have studied the impact of human capital on economic growth. The general conclusion is that this factor is a critical driver of countries' economic growth.

Human capital encompasses the set of intangible resources inherent to the labor factor that improves its productivity, being associated with the skills and knowledge acquired by individuals through experience, education and health care (Schultz, 1961; Becker 1962). The increase in schooling allows individuals to become innovative and more productive, leading to improvements in the factor productivity (Romer, 1990; Benhabib & Spiegel, 1994, Bodman & Le, 2013).

At the aggregate, country, level, the improvements achieved in labour productivity through human capital result in enhanced economic growth (Barro, 1991; Benhabib & Spiegel, 1994; Sianesi e Reenen, 2003; Hanushek & Woessmann, 2008).

Table 1: Selected studies on the impact of (types) of entrepreneurship on Economic growth

Author	Countries	Time- Frame	Methodology	Dependent variable	Data Source	Independent variable		Data Source	Results regarding entrepreneurship		
									Overall	Opportunity	Necessity
Acs, Audretsch, Braunerhjelm & Carlsson (2012)	18 countries	1981 to 1998, 1990 to 1998	Davidson and Mackinnon (1993) test of exogeneity and standard fixed effects model	5-year moving average of gross domestic product growth per capita	OECD, Statistical Compendium via Internet, (National Accounts vol. 1, and own calculations)	Core variable	Entrepreneurship	OECD, Statistical Compendium via Internet (Labor Market Statistics)	+++	N/A	N/A
						Other variables	Gross domestic expenditure on Research & Development (R&D) as percentage of gross domestic product (GDP)	OECD, Statistical Compendium via Internet (Industry Science and Technology)			
							Education	Penn World tables			
							Government expenditures as % of GDP	OECD, Statistical Compendium via Internet (Historical Statistics)			
							Capital stock/employment	OECD, Statistical Compendium via Internet (OECD Economic Outlook Stat & Proj)			
							Total population living in urban areas	World Bank (2002), World Development Indicators CDROM			
							Age	Values only available for 1978, 1985, 1990, 1994 and 1998. Values in between are approximated by assuming constant change between the years			
							Unemployment	OECD, Statistical Compendium via Internet (National Accounts and Historical Statistics)			
Urbano & Aparicio (2016)	43 countries: 25 OECD countries and 18 non-OECD countries	2002 to 2012	Data Estimation in Panel with Fixed Effects	Gross domestic product (GDP)	World Development Indicators (WDI) by World Bank	Core variables	Overall entrepreneurial activity	Global Entrepreneurship Monitor (GEM)	+++	+++	++
						Opportunity TEA					
						Necessity TEA					
						Other variables	Gross capital formation (in ln)	World Development Indicators (WDI) by World Bank			
							Government consumption (in ln)				
							Savings (ln)				
							Population ages 15-64				
							Age				
Wong, Ho & Autio (2005)	37 countries	1997/1998 to 2001/2002	Linear least squares regression	Growth in GDP per worker	World Economic Outlook by the International Monetary Fund (IMF)	Core variables	New Firm Creation – measured by High Potential TEA, Necessity TEA, Opportunity TEA and overall TEA rates	Global Entrepreneurship Monitor (GEM)	N/A	0	0
						Other variables	Base year GDP per Worker	Euromonitor Global, Market Information Database (GMID)			
							Growth in Capital per worker				
							Technological Innovation intensity	US Patents and Trademark Office (USPTO)			

Author	Countries	Time- Frame	Methodology	Dependent variable	Data Source	Independent variable		Data Source	Results regarding entrepreneurship		
Ferreira, Fayolle, Fernandes & Raposo (2017)	49-56 countries	2009 to 2011; 2012; 2013	Data Estimation in Panel with Fixed Effects	GDP growth (GDP_GR)	Organization for Economic Co-operation and Development and World Bank	Core variable	Schumpeterian entrepreneurship (INNOV)	Global Entrepreneurship Monitor (GEM)	+++	+++	N/A
							Kirzenian entrepreneurship (OPP)				
							Total Early-Stage Entrepreneurial Activity (TEA)				
				Other variables	World Economic Forum	Foreign direct investment (FDI)	International Monetary Fund				
						Net goods exports (NET_EXP)					
					Labor productivity (LP)	International Labor Organization, Organization for Economic Co-operation and Development and World Bank	Gross capital formation (GCF)	Organization for Economic Co-operation and Development and World Bank			
							Life expectancy at birth (L_EXP)				
							Total population (POP)				
							Rural population (RURAL_POP)	United Nations and World Bank			
Valliere & Peterson (2009)	44 countries (20 emerging and 24 developed)	2004 to 2005	Hierarchical regression	GDP growth rate (GDPG)	Global Entrepreneurship Monitor (GEM)	Core variables	Overall entrepreneurial activity	Global Entrepreneurship Monitor (GEM)	+	+	+
							Opportunity TEA				
							Necessity TEA				
						Other variables	Annual GDP growth rate	Global Competitiveness Reports			
							One-year lagged value of GDPG				
							Per-capita GDP, purchasing power parity				
							Per-capita foreign direct investment company spending on R&D				
							Intellectual property protection				
							Firm-level technology absorption				
							Several others				
Mrożewski & Kratzer (2017)	96 countries	2001 – 2012, 2006 - 2013	Linear regression (OLS)	Country innovativeness	World Economic Forum	Core variables	Necessity entrepreneurship	Global Entrepreneurship Monitor (GEM)	N/A	++	--
							Opportunity entrepreneurship				
							Entrepreneurial opportunity availability (EOA)				
						Other variables	Country-level innovation (GCI innovation)	World Bank			
							Country size (POP)				
							Quality of human capital (EDUC)				
							Openness to international capital flows (FDI)				
							Quality of institutional environment				

Legend: +++ (++) (+) [---] (--) (-) statistically and positively [negatively] significant at 1% (5%) (10%); 0: not significant; N/A: not applicable
Source: Own elaboration.

Considering the above, we conjecture that:

Hypothesis 3: Human capital positively impacts on countries' economic growth.

Given that entrepreneurship is highly dependent on human capital attributes of entrepreneurs (Marvel, Davis & Sproul, 2016), the impact of the former on economic growth is likely to be intermediated by countries' endowments in terms of education, experience and skills.

Such contribution tends to be even greater when the absorption and innovation capacity of a country is more intense (Nelson & Phelps, 1966), usually translated into higher levels of opportunity entrepreneurship. The more educated individuals are the greater is their ability to overcome social obstacles and take advantages of business opportunities that emerge and to deal with the risks and uncertainty inherent to self-employment (Lackéus, 2015).

Therefore, we conjecture that:

Hypothesis 4: Human capital positively intermediates the impact of (types of) entrepreneurship on countries' economic growth.

2.2.3. Other determinants of economic growth

A myriad of factors (beside entrepreneurship, the types of entrepreneurship, and human capital) are likely to affect countries' economic growth: physical investment (through public infrastructure capital or private sector) (Barro, 1991, 1996; Nourzad & Powell, 2003), population growth (Nourzad & Powell, 2003), trade openness (Barro, 1996; Nourzad & Powell, 2003) and corruption (Barro, 1991; Neeman & Paserman, 2008).

Several other factors were added by Barro (1996): life expectancy and fertility rates, the quantity (male secondary and higher schooling) and quality of education, expenditures in Research and Development (R&D), openness to trade, distribution of income and wealth, public policies (regarding taxes, pension and other transfer programs, and labour, financial and other markets regulations), and infrastructure investments.

3. Methodological aspects

3.1. Main hypotheses and method of analysis

The main goal of this study is to measure the impact of (the types of) entrepreneurship on economic growth, directly and indirectly through human capital. According to the literature review (Section 2), four main hypotheses are to be tested:

Hypothesis 1: Entrepreneurship affects positively countries' economic growth.

Hypothesis 2a-c: Opportunity (Necessity) entrepreneurship affects positively countries' economic growth being the impact of opportunity entrepreneurship on countries' growth higher than that of necessity entrepreneurship.

Hypothesis 3: Human capital positively impacts on countries' economic growth.

Hypothesis 4: Human capital positively intermediates the impact of (types of) entrepreneurship on countries' economic growth.

The development of rich generalizable theories might involve both quantitative and qualitative methods (Wilson, Whitmoyer, Pieper, Astrachan, Hair Jr. & Sarstedt, 2014). The present study, similar to other studies in the area (see Table 1), resorts to quantitative methods of analysis. According to Ferreira & Serra (2009), a quantitative research occurs when researchers use quantitative data about the object to be studied, and statistical tests are performed. These data can be collected directly or indirectly, through specific sources for the study to be performed (Fortin 1999; Ferreira & Serra, 2009). Using the quantitative research method, it is possible for the researcher to compare, reproduce and generalize similar situations, obtaining a greater degree of precision and objectivity given the systematization in the process of gathering data objectives and events which is independent from the researcher (Freixo, 2011).

Taking into account the studies described in Table 1, some authors choose different types of quantitative methods in order to pursue and achieve their goals. Specifically, they involve estimations using a panel fixed effects (Urbano & Aparício, 2016; Ferreira et al., 2017), hierarchical regression (Valliere & Peterson, 2009), linear regression (OLS) (Mrożewski & Kratzer (2017), and linear least squares regression (Wong et al., 2005).

3.2. Econometric specification and selection of the estimation technique

In light of the literature reviewed (see Section 2), the baseline econometric specification regresses the level of the *per capita* Gross Domestic Product (GDPpc) against total entrepreneurial activity (TEA), human capital (HC), the interaction between TEA and HC and a set of control variables, **X** (trade openness, physical investment, government consumption, population growth, and institutional quality). The econometric specification of the model to estimate is:

$$y_{i,t} = \beta_1 + \beta_2 TEA_{i,t} + \beta_3 TEA_{i,t} \cdot HC_{i,t} + \beta_4 HC_{i,t} + \beta_5 X_{i,t} + \mu_{i,t},$$

where:

i represents the country and *t* represents time;

y represents the *per capita* Gross Domestic Product (GDPpc)

HC represents a measure for the stock of human capital

TEA represents a measure for the total entrepreneurial activity

*TEA * HC* interaction between the measures of human capital and the total entrepreneurial activity

X encompasses the measures of the trade openness, physical investment, government consumption, population growth, and institutional quality

$\mu_{i,t}$ is the error term.

Along with this basic equation, an analysis is made of the impact of the types of entrepreneurship on economic growth. The extended econometric specification is similar to the baseline, but instead of considering TEA, it included the opportunity entrepreneurial activity (OEA) and necessity entrepreneurial activity (NEA):

$$y_{i,t} = \beta'_1 + \beta'_2 OEA_{i,t} + \beta'_3 NEA_{i,t} + \beta'_4 OEA_{i,t} \times HC_{i,t} + \beta'_5 NEA_{i,t} \times HC_{i,t} + \beta'_6 HC_{i,t} + \beta'_7 X_{i,t} + \mu'_{i,t}. \quad (1)$$

In the above equation, the dependent variable (*y*) represents the *per capita* Gross Domestic Product (GDPpc); OEA represents the Opportunity Entrepreneurial Activity

and NEA represents the Necessity Entrepreneurial Activity; OEA * HC is the interaction between Human capital and the Opportunity Entrepreneurial Activity while NEA* HC means the interaction between Human Capital and Necessity Entrepreneurial Activity; $\mu_{i,t}$ is the error term.

In order to estimate the effects of the relevant variables on economic growth, such as, human capital and its interaction with different types of entrepreneurship, and in line with previous studies by Urbano & Aparício (2016) and Ferreira et al. (2017), we selected panel data techniques for estimating the econometric specification described above.

It is important to bear in mind that when the described data is characterized by a combination of time series and cross-sectional dimensions, the study should employ panel data techniques. These panel techniques are typically assorted by three approaches: (1) Random effects model (the independent variables are uncorrelated with time constant individual effects); (2) Fixed-effects model (it exists a correlation between the explanatory variables and time invariant individual effects); and (3) pooled OLS estimator (it is a simple linear regression using a panel data arrangement) (Johnston & DiNardo, 1997; Gil-García & Puron-Cid, 2013).

Johnston & DiNardo (1997) and Greene (2001) argue that the OLS estimation may not be a proper technique for a panel data due to the nature of the pooling method to contempt the distinct attributes of individuals. In this context the authors recommended the use of random or fixed-effects models.

The method of analysis through panel data models allows the researcher to study the adjustment dynamics when carrying out an analysis in dynamic terms, estimating effects over a long period of time (Greene, 2011). Additionally, it provides more information when allowing the analysis of a set of variables for a large number of countries (Greene, 2011). The estimation of panel data also allows us to assume that countries are heterogeneous with unobservable and specific characteristics. On the other hand, times series and cross-section estimates do not allow to control this heterogeneity, and because of that, the results may be skewed (Greene, 2011).

In the context of panel models, it is important to consider the existence of two types: 'random effects model' (REM) and 'fixed effects model' (FEM). The later “computes estimates from differences in variables within country across time, on the assumption that individual effects are correlated over time, but are unrelated to other regressors” (Batten

& Vo, 2009: pp. 1626). In contrast, the REM assumes that the observations (the countries) have unobservable and constant effects over time that are not correlated with the explanatory variables (Dreher, 2006; Batten & Vo, 2009). One advantage of FEM is that does not attend to the problem of omitted variables (Batten & Vo, 2009). If the researcher selects the wrong econometric model it can be a huge problem because it can lead to wrong inferences (Onali, Ginesti & Vasilakis, 2017).

These methods must be preceded by specification tests, namely the Hausman test, in order to determine which of the two models are the most suitable (Johnston & DiNardo, 1997). When the Hausman test is insignificant, the REM model should be chosen because if the FEM model is used instead it “may result in statistically insignificant coefficients even when they would be statistically significant for the REM model” (Onali et al., 2017: pp. 463). The null hypothesis (H0) of the Hausman test establishes that the fixed effects model is less efficient than the random effects model.

3.3. Variable proxies, data collection and sources

Our dependent variable is the per capita gross domestic product (GDPpc), in purchasing power parities (PPP), at constant prices (base year 2010) thousands of dollars, which is consider as one of the best-known indicators of material economic performance (Urbano & Aparício, 2016) and it is also used by studies such as Wong et al. (2005), Dreher (2006) and Batten & Vo (2009). The data source for this measure is the World Development Indicator (WDI) by the World Bank.

The core independent variables are the total entrepreneurial activity (TEA), opportunity entrepreneurial activity (OEA), and the necessity entrepreneurial activity (NEA), which are withdrawn from the Global Entrepreneurship Monitor (GEM). The total entrepreneurial activity is measured by “the percentage of adults aged 18–64 setting up a business or owning–managing a young firm (up to 3.5 years old), including self-employment”.¹ The OEA is measured by “the percentage of adults aged 18–64 who are setting up or owning–managing a young firm (up to 3.5 years old), including self-employment and that are motivated to pursue perceived business opportunities”.² On the other hand, NEA is measured by the “percentage of adults aged 18–64 who are setting up

¹ Information extracted from the Global Entrepreneurship Monitor (GEM)

² Information extracted from the Global Entrepreneurship Monitor (GEM)

a business or owning–managing a young firm (up to 3.5 years old), including self-employment that are involved in entrepreneurship because they have no better option for work”.³

These proxies of the GEM are internationally related measures of entrepreneurship and its subtypes, being constantly applied in empirical country-level investigations (e.g. Van Stel et al., 2005; Wennekers et al., 2005; Wong et al., 2005).

We also proxied OEA as Employers (E), and NEA as Self-Employment (SE) (both in percentage of total employment). The data for these proxies are gathered from the World Development Indicators (WDI) by World Bank.

In order to collect the data for the other independent variable, Human Capital (HC), which is measured by one of the most used proxy that is, the average number of years of formal education of the working age population (25 years old and older), we use the Penn World Tables (Version 8.0)⁴ (Moral-Benito, 2012; Bodman & Le, 2013). Barro & Le (2010) constructed a database that covers the period from 1950 to 2010, referring to more than 100 countries, which has been broadly used in the literature on economic growth, along years. The data come from Eurostat, UNESCO, and national agencies, among others. The recent unavailability of data only allows us to study this variable until the year 2010.

The other independent, control, variables, include Trade Openness (O), measured by the percentage of imports and exports of goods in terms of GDP; Physical Investment (I), measured by the Investment in physical capital (in percentage of the GDP) (Barro, 1991; Moral-Benito, 2012); Government Consumption (G), measured by the weight of public consumption in GDP and Population Growth (POP), measured by the population annual growth rate. All these indicators come from the World Development Indicators (WDI) by World Bank. Finally, the variable Institutional Quality (INST) is measured by the corruption index and it was obtained from the Transparency International.

The description of the variables, period of data availability, and their source are presented in Table 3.

³ Information extracted from the Global Entrepreneurship Monitor (GEM).

⁴ Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, Vol. 105, N° 10, pp. 3150-3182, available for download at www.ggdnet.net/pwt.

Table 3: Variables description and data sources

	Variables	Description	Proxies	Period	Source
Dependent	Gross Domestic Product per capita (GDPpc)	Measure of the total output of a country that takes gross domestic product (GDP) divided by the number of people in the country	Gross Domestic Product per capita (GDPpc)	1990 to 2016	World Development Indicator (WDI) by World Bank
Independent	Total entrepreneurial activity (TEA)	Percentage of individuals who set up a business or owning-managing a young firm.	Percentage of adults aged 18–64 setting up a business or owning–managing a young firm (up to 3.5 years old), including self-employment.	2001 to 2016	Global Entrepreneurship Monitor (GEM)
	Opportunity entrepreneurial activity (OEA)	Percentage of individuals who set up a business or owning-managing a young firm who are motivated to pursue perceived business opportunities	Percentage of adults aged 18–64 setting up a business or owning–managing a young firm (up to 3.5 years old), including self-employment who are motivated to pursue perceived business opportunities.	2005 to 2015	
		Employers % total employment	Percentage of workers who, working on their own account or with one or a few partners, hold jobs where the remuneration is directly dependent upon the profits derived from the goods and services produced), and that have one or more persons to work for them as employee(s).	1991 to 2017	World Development Indicator (WDI) by World Bank
	Necessity entrepreneurial activity (NEA)	Percentage of individuals who set up a business or owning-managing a young firm because they have no better option for work	Percentage of adults aged 18–64 setting up a business or owning–managing a young firm (up to 3.5 years old), including self-employment who are involved in entrepreneurship because they have no better option for work	2005 to 2015	Global Entrepreneurship Monitor (GEM)
		Self-employment % total employment	Percentage of workers that have their own business or work with one or a few partners and that hold jobs where the remuneration is directly dependent upon the profits derived from the goods and services produced.	1991 to 2017	World Development Indicator (WDI) by World Bank
	Human Capital (HC)	Human capital	Average number of years of formal education of the working age population (>25 years)	1950 to 2011	Penn World Tables
Control variables	Trade openness (O)	Represent the value of all goods and other market services received/provided from/to the rest of the world.	Percentage of imports plus exports of goods and services in terms of GDPpc	1960 to 2016	World Development Indicators (WDI) by World Bank
	Physical investment (I)	It consists in the acquisition/investment in a tangible, hard or real asset	Gross capital formation as percentage of the GDPpc	1960 to 2016	
	Government consumption (G)	All government current expenditures for purchases of goods and services, in percentage of the GDP	Government consumption as percentage GDP	1960 to 2016	
	Population growth (POP)	It can be measured by the difference between birth rates and death rates	Population growth rate	1960 to 2016	
	Institutional quality (INST)	It corresponds to the measure of the quality of governance and institutions in a country ⁵	Corruption index	1995 to 2016	Transparency International

Note: Information related to the variables description and respectively proxies available on the associated inquires and accessed on January 2018.

Source: Own elaboration

⁵ Information available on: <https://www.igi-global.com/dictionary/institutional-quality/44120> and accessed on January 2018.

In terms of data, the present study considers a sample of 79 countries - 34 OECD and 45 non-OECD countries⁶ (see Annex 1 for the list of countries) – for which we found data for all the (dependent and independent) variables.

We estimate two models for the specification (1), which reflect the usage of two distinct data sources for the main independent variables respecting the entrepreneurship types. Model II includes Employers (E) and Self-Employment (SE) as alternative proxies for the variables ‘opportunity entrepreneurial activity’ and ‘necessity entrepreneurial activity’, respectively and comprises the period between 1990 and 2016 (26 years). Model I uses GEM’s related proxies for a shorter period, 2005 - 2016 using the variables of total. Table 2 presents a summary of the data information regarding the models’ variables.

Table 2: Model’s selected period of analysis

	Variables		Period	
			Model I 2005-2016	Model II 1990-2016
Depend.	Gross Domestic Product per capita (GDPpc)			
Independent	Total entrepreneurial activity (TEA)			
	Opportunity entrepreneurship	GEM –opportunity entrepreneurial activity		
		Employers (E)		
	Necessity entrepreneurship	GEM – necessity entrepreneurial activity		
		Self-Employment (SE)		
	Human Capital (HC)			
Control	Trade Openness (O)			
	Physical investment (I)			
	Government consumption (G)			
	Population growth (POP)			
	Institutional quality (INST)			

Note: Blank cells means that the variables are not included.

Source: Own elaboration

⁶ We used the classification of the OECD: <http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm>, accessed on January, 2018.

4. Chronogram of the Work

We present in this section a schedule of the activities that we are going to develop from now on.

Tasks	01/18	02/18	03/18	04/18	05/18	06/18	07/18
Methodology							
Data collecting							
Data processing							
Models estimation							
Results discussion							
Conclusion							
Dissertation draft conclusion							
Thesis submission							

Source: Own elaboration

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Annex

Annex 1. List of Countries

	COUNTRY	OECD COUNTRIES	NON-OECD COUNTRIES
1	ARGENTINA		X
2	AUSTRALIA	X	
3	AUSTRIA	X	
4	BANGLADESH		X
5	BARBADOS		X
6	BELGIUM	X	
7	BELIZE		X
8	BOLIVIA		X
9	BOTSWANA		X
10	BRAZIL		X
11	BULGARIA		X
12	CAMEROON		X
13	CANADA	X	
14	CHILE	X	
15	CHINA		X
16	COLOMBIA		X
17	COSTA RICA		X
18	CROATIA		X
19	CZECH REPUBLIC	X	
20	DENMARK	X	
21	DOMINICAN REPUBLIC		X
22	ECUADOR	X	
23	EL SALVADOR		X
24	ESTONIA		X
25	FINLAND	X	
26	FRANCE	X	
27	GERMANY	X	
28	GHANA		X
29	GREECE	X	
30	GUATEMALA		X
31	HUNGARY	X	
32	ICELAND	X	
33	INDIA		X
34	INDONESIA		X
35	IRELAND	X	
36	ISRAEL	X	
37	ITALY	X	
38	JAMAICA		X
39	JAPAN	X	
40	JORDAN		X
41	KAZAKHSTAN		X
42	LATVIA	X	

	COUNTRY	OECD countries	Non-OECD countries
43	LITHUANIA		X
44	LUXEMBOURG	X	
45	MALAWI		X
46	MALAYSIA		X
47	MEXICO	X	
48	MOROCCO		X
49	NAMIBIA		X
50	NETHERLANDS	X	
51	NEW ZEALAND	X	
52	NORWAY	X	
53	PAKISTAN		X
54	PANAMA		X
55	PERU		X
56	PHILIPPINES		X
57	POLAND	X	
58	PORTUGAL	X	
59	QATAR		X
60	ROMANIA		X
61	SAUDI ARABIA		X
62	SENEGAL		X
63	SERBIA		X
64	SINGAPORE		X
65	SLOVAK REPUBLIC	X	
66	SLOVENIA	X	
67	SOUTH AFRICA		X
68	SPAIN	X	
69	SWEDEN	X	
70	SWITZERLAND	X	
71	THAILAND		X
72	TUNISIA		X
73	TURKEY	X	
74	UGANDA		X
75	UNITED KINGDOM	X	
76	UNITED STATES	X	
77	URUGUAY		X
78	VIETNAM		X
79	ZAMBIA		X
	TOTAL	34	45

Source: Own elaboration