Revisiting Entrepreneurship: The contribution of dynamic entrepreneurial activity to economic growth

Abstract

This paper revisits the effect of entrepreneurship on economic growth. We conduct the analysis with three different measures: dynamic, regular and unipersonal entrepreneurship. Using a macro panel dataset of 100 countries for the period 2001-2016, we empirically analyze the differences in contribution to economic growth. Particularly, using an extension of the model developed by Wong, Ho, and Autio (2005) we show the role of entrepreneurship in emerging and advanced economies. Global Entrepreneurship Monitor (GEM) and World Bank data were used to estimate the proposed types of entrepreneurship. Our contribution uncovers evidence for the effect of entrepreneurial activities in emerging countries. We found a positive and significant relationship between dynamic entrepreneurship and economic growth for both stages of economic development: advanced and emerging. This result suggests that — not only in advanced economies but also in developing countries — a significant proportion of economic growth can be explained by a *specific* type of entrepreneurship. Our results remain robust to a variety of specifications that include two different samples with economic, social and cultural controls.

Keywords: Entrepreneurship, economic growth, dynamic entrepreneurship, emerging economies, innovation, knowledge.

JEL Classifications: C14, C23, G21, L10

1. Introduction

Growth is one of the most reviewed issues in the economic field. Productivity factors, knowledge and technology are the most common sources of economic growth, nevertheless in the last decade studies have returned to see the entrepreneurial activity as a source of growth (Audretsch & Kelibach, 2008). Authors have addressed this issue in many aspects: spillovers (Carlsson, Acs, Audretsch, & Braunerhjelm, 2009), Schumpeterian view (Wennekers & Thurik, 1999), motivation and risk (Hampel-Milagrosa, Loewe, & Reeg, 2015), capital (Urbano & Aparicio, 2016) and innovation (Wong, Ho, & Autio , 2005), to name some.

In this sense, there has been a growing body of empirical literature related to the role of entrepreneurship on economic growth. This issue has been deeply analyzed with the advance of the global standardized metrics of entrepreneurship developed by GEM. In most of the cases, the analysis was conducted relating growth and entrepreneurship measured by the total early stage of entrepreneurial activity (TEA) or self-employment estimates. Such is the case of Stel, Carree and Thurik (2005); Samila and Sorenson (2011); Acs and Audretsch (2012); Prieger, Bampoky, Blanco and Liu (2016); Coulibaly , Erbao, and Mekongcho (2018) and Dhahri and Anis (2018).

Other researchers have concentrated in the effect of the different types of TEA which include reasons why individuals decide to get involved in entrepreneurial activities, i.e. opportunities, necessity. Thus, also analyzing the dynamic part of entrepreneurial activities which correspond to the high-expectation growth entrepreneurs Wong, Ho, and Autio (2005) and Valliere and Rein (2009). Others like Acs, Estrin, Mickiewicz, and Szerb (2018) under a theoretical view of institutions have proposed a relationship between entrepreneurship — as an ecosystem — and growth.

Despite the efforts of social scientists to understand the mechanisms under entrepreneurship leads to better conditions for the nations, a great part of their research have taken specially attention to the relationship per se even when conceptual literature suggest that differences between stages of development exist. In the attempt to give a light in this area, Valliere and Rein (2009) have empirically studied the effect of entrepreneurship for developed and developing countries separately. They found that new firms creation does not have a certain effect over economic growth for both stages of development. This result can be tied to a close relationship between the persistence of new businesses and the access to a formal market; suggesting that this kind of entrepreneurial activity does not guarantee faster rates of growth. While it is true that they have mentioned that not all entrepreneurship is leading to development, they also demonstrated that there is a type of entrepreneurship that directly affects economic growth, the "gazelle" entrepreneurship. This belief is particularly true in advanced economies, nevertheless, they did not find evidence of this effect for the emerging economies. This suggest that, for developing countries it is needed to reach a threshold level of development before experiencing this effect fully.

In global terms, recent empirical evidence suggests that new business creation measured by TEA has a positive effect over growth rates (Coulibaly, Erbao, & Mekongcho, 2018; Dhahri & Anis, 2018). Similarly, Acs and Audretsch (2012) have found a positive relationship between

self-employment and growth. In such conditions, it is less clear whether entrepreneurship activity has a little, or even significant impact on growth rates for emerging countries.

This research attempts to uncover evidence for the effect of entrepreneurship in emerging countries. To analyze this relationship, it is crucial to focus on the metrics. Despite the common use of the TEA as a measure for entrepreneurship, we summarized it into three more explicative and straightforward measures, dynamic, regular and unipersonal entrepreneurship. Although not free of criticism, these metrics comprise adequately the entrepreneurial activity and captures differences across types of entrepreneurship. A different story holds when it comes to the analysis of economic growth. Several models have been developed in terms of different theories, in this paper we use an extension to the model proposed by Wong, Ho, and Autio (2005).

Therefore, due to the lack of conclusive empirical evidence in turn of whether entrepreneurship is contributing to economic growth rate changes in developing countries. Our main contribution is given by three streams. First, using an aggregate Cobb-Douglas production function, we analyze economic growth over the years 2001-2016. Then we develop an analysis of entrepreneurship in a disaggregate method dividing it by dynamic, regular, and unipersonal entrepreneurship. Usually it has been studied with TEA or self-employment measures, but no evidence was found between the dynamic vs regular form of entrepreneurship. Similar approaches related to dynamic entrepreneurship have reported data limitations Wong, Ho, and Autio (2005); Valliere and Rein (2009). Moreover, those studies have only concentrated in the dynamic part of entrepreneurship not so in the regular part. Second, while controlling for natural resources, level of investment, social and cultural factors we uncover evidence of a positive relationship between productive entrepreneurship and growth rates for *emerging* countries. Furthermore, our specification is tested by a robustness check with a forecasted sample to obtain more degrees of freedom. By last, three metrics are introduced for the analysis of entrepreneurship and growth: effective innovation, unipersonal entrepreneurship and regular entrepreneurship.

The rest of the paper is organized as follows: in section two, we summarized the relationship between entrepreneurship and economic growth as well as economic theories of growth; on section three we formalize the research objectives; section four describes the data sources used and the empirical methods; section five relates the findings; section six presents the narrative of the results; and finally section seven concludes.

2. Literature Review

2.1. Entrepreneurship and economic growth

There is a wide theoretical literature that relates entrepreneurship to economic growth. A conceptual framework derives from the seminal work of Schumpeter (1911) who mentions that entrepreneurship can be a driving force to economic development. Despite the theoretical sources, it was largely difficult to formalize it until the last decade due to the absence of a "formal" metric for entrepreneurship. With the advance of data collection by GEM and other sources; the conceptual schemes of this theory have motivated many scholars to empirically test the influence of entrepreneurship over growth rates.

The channels through entrepreneurship leads to economic growth are several, nonetheless, it is possible to mention that to some degree the work of Baumol (1993a) (1993b) represents the breakpoint to the link between entrepreneurship and growth. Conversely to the neo-classical growth theory that have concentrated on the contribution of productivity factors — capital and labor — to the process of economic development. Several authors start to think in entrepreneurship as a source of growth under the Adam Smith's vision of growth where entrepreneurial activities are viewed as profit opportunities. Thus, leveraging in the studied by Kirzner (1973) — who mentions that the process matter more than inputs in the production *ergo* economic growth — entrepreneurship could be tied with growth through these profit opportunities. Later, the new economic theory of growth landed these ideas and allows us to fit the entrepreneurship into growth models.

The link between entrepreneurship theories and endogenous growth Romer (1986) (1990); Lucas (1988) can be summarized in the conceptualization of entrepreneurship as a special form of human capital. Consequently, endogenous growth theory has focused on the intermediate variables: capital (human) formation and innovation (Wennekers & Thurik, 1999). Endogenous growth also tries to explain growth through the spillovers of knowledge. As mentioned before by Agarwal , Audretsch, and Sarkar (2007), entrepreneurship is one mechanism that converts knowledge into growth.

In this sense, a joint vision on the phenomena could be explain in two parts: first, the Schumpeterian view of "entrepreneur as innovator" that suggest a directly proportional relationship between entrepreneurial activity and growth; and second, better explained by Schmitz (1989) where new firm creation is and endogenized determinant of economic growth.

2.2. Summary and Empirical Evidence

As discussed above, there is an important debate in turn the real effect of entrepreneurship over the global economy. For the one hand, there is literature that supports the fact that ventures help to increase growth rates in developed countries (Acs, Audretsch, Braunerhjelm, & Carlsson, 2012); (Mueller, 2007), for the other one, less is known about its effect in developing countries. In this line, Sautet (2013) mentions that the effect of entrepreneurship is not stablished for this type of economies and (Naudé, 2011) argues that entrepreneurial activity is far from development and growth for developing/emerging countries. In doing so, it is possible to mention that the relationship between growth and entrepreneurship in developing countries in not clear at all, moreover, there is not conclusive evidence that relate these factors (Prieger, Bampoky, Blanco, & Liu, 2016).

There are several works that have addressed the drivers of economic growth. Most of them, are based on some form of Coob-Douglas production function where the outcome is explained by capital, labor and the disembodied factor productivity. In this line is the case of Wong, Ho, and Autio (2005) and Valliere and Rein (2009)**.** They have studied the role of dynamic entrepreneurship and growth through a different set of specifications. Both have used GEM data to test the relationship, nonetheless, they have faced several limitations. For the one hand, Wong et al. (2005) — using a cross-sectional dataset for the year 2002 — concludes that dynamic entrepreneurship has a positive effect over economic growth supporting the base idea of Birch, Haggerty , & Parsons (1997) who argues that not all entrepreneurship have a positive effect on

development. Despite their contribution, they mention that findings are exploratory due to the limitation of data to capture entrepreneurial activity. For the other hand, Vallerie and Rain have studied the same issue but giving evidence for emerging and advanced economies. Additionally, they incorporate control variable for the different theories of economic growth i.e. new economic geography, endogenous growth theory and national systems of innovation. Their findings are in the same line of Wong et al. arguing that dynamic entrepreneurship is the most relevant part in economic growth changes. Into other things, they *did not find* evidence of the effect for developing countries. Nevertheless, they also mention that limitations on the data and the countries included in the analysis limit the generalizability of their conclusions. There is other research conducted by Prieger, Bampoky, Blanco, & Liu (2016) who also provide evidence for different stages of development. Likewise, others as Stel, Carree and Thurik (2005); Samila and Sorenson (2011); Acs and Audretsch (2012); Prieger, Bampoky, Blanco and Liu (2016); Coulibaly , Erbao, and Mekongcho (2018) and Dhahri and Anis (2018)have studied in a more general vision the relationship.

3. Background and Hypothesis

3.1. *The enigma of entrepreneurship*

It is well known that not all self-employment is entrepreneurial, moreover the mechanism in which entrepreneurship improves economic development is complex. Emerging economies have higher rates of self-employment, nevertheless, they achieve low levels of income. Understanding what is falling behind the effect of entrepreneurship in emerging markets is possibly one of the most relevant topics in this research agenda. Thus, the main objective of this paper is to address this issue for emerging economies by defining entrepreneurship in an appropriate way. More clearly, we seek to answer the question of whether the dynamic part of entrepreneurship would increase economic growth rates in the emerging economies. Our research also tries to give robust empirical evidence applicable to the question: Which types of entrepreneurship are relevant to the analysis of entrepreneurship and growth?

To deal this task we attempt to formalize the conceptual ideas in turn to entrepreneurship to test the possible disparities between stages of economic development. Using an extended approach to the one showed in Wong, Ho, and Autio (2005) and leveraging in endogenous growth theory; we hypothesize that changes in growth rates will depend on three key factors: innovation, institutions and knowledge. We suggest that these factors are encompassed in the disembodied factor productivity. Thus, we perform an analysis where not only the natural factors of productivity produce changes in growth rates but also, we try to explain the how economic development can be affected through the disembodied factor by entrepreneurship, effective innovation, institutions and knowledge.

3.2. *Innovation and Economic Growth*

Several works have focused on the role of innovation over economic growth, this is basically due to its importance to the disembodied productivity component. There are many proxies used to capture the effect of innovation, to name some patents and R+D expenditure are the most used.

On the other hand, leveraged in the Schumpeterian view of entrepreneurial activities, these are not only classified by market entry of new firms but also by the innovative new entries into the market. In this sense, entrepreneurship can be a source of innovation transference to the economies (Wong, Ho, & Autio , 2005). Entrepreneurship is also related with the creation of knowledge through innovation transferring advances in knowledge into economic growth (Acs, Estrin, Mickiewicz, & Szerb, 2018). In short, it is possible to remark that entrepreneurship acts as an innovation source that could affect economic growth rates.

Contrariwise to the neoclassical theory — where innovation is treated as exogenous — we treat it endogenously with the belief that innovation is closely tied to the local conditions of the market.
Hence, possible differences in the effect of innovation produced by the R+D expenditure or patents are expected. On the other hand, less is known about the innovation source from entrepreneurship. Basically, we hypothesize that the innovation part from entrepreneurial activities can be captured by the dynamic entrepreneurship arguing that not all entrepreneurial activities produce economic development but just a part of it.

In the attempt of compile a complete metric for innovation we treat it as the result of two components: entrepreneurial activities: (dynamic + regular) and effective innovation. Therefore, the examination of economic growth and innovation lead us to the subsequent hypotheses:

i. Entrepreneurial activities lead to economic growth, but it depends on the type.
ii. Effective innovation matters to economic growth, but it matters differently in emerging and advanced economies.

3.3. *Institutions and Economic Growth*

The base of the idea behind the relationship between institutions and economic growth is given by the notions showed in Acemoglu, Johnson, & Robinson (2005) who mention the importance of institutions in the studies of economic growth. Moreover, they mention that the disparity in the quality of the institutions can produce differences in economic outcomes. This fundamental has been later tested by Fatas & Mihov (2013) who have found similar results. In this context, we treat institutions as a main part for the analysis of economic growth and entrepreneurship.

In doing so we hope that better condition of institutions is positively correlated with economic growth, hypothesizing that:

iii. Better conditions of institutions will improve economic growth rates

4. Empirical Methods

4.1. Data

We construct an unbalanced panel dataset covering 59 countries from year 2001 to 2014 using variables from several sources. **Appendix A** lists variables chosen for this paper, including a definition. **Table 1** lists the raw variables, their sources, period of availability and missing values. The common time-frame for all the source data is 2000-2014, but since our model includes lags for GEM variables (which are only available since 2000), the final period of study is 2001-2014. Nonetheless, to get more degree of freedom and use the availability of the

economic and entrepreneurial metrics we perform the analysis with an extended sample that is explained in detail in section **4.2**. All in all, we identified 59 countries with at least one year of non-missing data (see **Appendix B** for more detailed information about country-year availability).

Data for GDP, net foreign direct investment, value added for industry sector, research and development expenditure, and total natural resources rents was retrieved from World Development Indicators[1]. Capital stock, employment and population were derived from the Penn World Table 9.0[2]. Data for patent grants was obtained from WIPO IP Statistics Data Center[3].

To measure country-level entrepreneurial activity prevalence, we rely on Global Entrepreneurship Monitor's (GEM[4]) Total early-stage Entrepreneurial Activity (TEA). TEA measures the sum of nascent entrepreneurs (those actively trying to start a business) and new business owners (former nascent entrepreneurs whose business has been in operation for less than 42 months). GEM data is collected with the Adult Population Survey (APS), with a sample of at least 2,000 respondents per country. The core questions of the survey are the same for every participant country, providing comparable measurements.

APS respondents are asked about their businesses' current and expected number of jobs. With this information GEM computes the High Job Creation Expectation TEA, identifying entrepreneurs who expect to create at least 10 additional jobs, with this quantity amounting to at least 50% more jobs than current. We use this as an indicator for dynamic entrepreneurship, while we refer to entrepreneurs without high job creation expectations as regular entrepreneurship, being the far more common of the two.

Since GEM's creation, a total of 112 countries have carried out the APS data collection process, but not for all years. In total, only 11 countries have data for every year in the 2001-2014 period. As can be seen in **Table 1**, this reduces our sample size.

We also construct an alternative measure for entrepreneurship using World Development Indicators' self-employment and employer rates. Using this variable, we first, are able to extend our sample size and second capture another part of entrepreneurship.

The Public Institutions index is obtained from the yearly editions of the Global Competitiveness Report (GCR), as a measure of public institutions quality for each country. Data for this report is obtained by survey of business executives. The index is constructed by taking the average sub-indexes, from 2007 and on, these consisted of: property rights, ethics and corruption, undue influence, public-sector performance, and security. Prior to 2007, the sub-indexes were: contracts and law, and corruption.

[1] https://data.worldbank.org/products/wdi
[2] https://www.rug.nl/ggdc/productivity/pwt/
[3] https://www3.wipo.int/ipstats/index.htm
[4] http://gemconsortium.org/

Table 1: Data availability and final dataset completeness

Sources	Variables	Unit of measurement	No. of countries	Period	Number of observations	
					Valid: 2001-2014	Missing: 2001-2014
GEM APS macrodata	TEA	% of population aged 18-64 y/o	112	2001-2016	670	926
	TEA gazelle	% of population aged 18-64 y/o	112	2001-2016	670	926
Penn World Table 9.0	Capital Stock	PPP 2011 USD, millions	182	1950-2014	2,520	28
	Labor	Number of persons, millions	182	1950-2014	2,399	149
	Population	Number of persons, millions	182	1950-2014	2,540	8
World Bank Indicators	Real GDP per capita	PPP 2011 USD	241	1990-2016	3,314	382
	Inflows	% of GDP	243	1970-2016	3,300	396
	Industry, value added	% of GDP	238	1960-2016	3,130	566
	Self-employment	% of total employment	233	1991-2017	3,262	434
	Employers	% of total employment	233	1991-2017	3,262	434
	Research and development expenditure	% of GDP	173	1996-2015	1,616	2080
	Total natural resources rents	% of GDP	256	1970-2016	3,468	228
Global Competitiveness Index[5]	Public institutions index	Avg. of 7-point Likert scale	159	2001-2017	1,712	107
KOF Globalisation Index	Social globalization (de jure)	Avg. of 100 point scores[6]	213	1970-2015	2,981	113
WIPO IP Statistics Data Center	Patent grants	Number of patents	159	1980-2016	1,320	1494
Final dataset using GEM data			59	2001-2014	432	394
Final dataset using World Bank employment data			70	2001-2014	611	331

[5] The Public Institutions index is taken from the Growth Competitiveness Index before 2004
[6] The variables that compose this index are normalized to a 1-100 scale. The average is weighted using principal components weights.

As explained in more detail in Section **4.4**, we ought to control for the national, social and cultural context, which, in part, accounts for the variance in the prevalence and economic role of entrepreneurship among countries (Valliere & Peterson, 2009). For this purpose, we use the social globalization component of the KOF Globalization Index[7].

Gygli, Haelg, & Sturm (2018) detail the methodology for the KOF Globalization index. This index is the weighted average of 42 indicators from 1970 to 2015, which are aggregated into three dimensions (economic, social, and political globalization), and the overall Globalization Index. For every indicator, missing data is imputed using linear interpolation or using the closest observation available. All these indicators are then normalized to a scale from one to one hundred. Finally, time-varying weights used for aggregation are computed every 10 years using principal component analysis.

The KOF Swiss Economic Institute provides two ways of measuring every indicator, dimension and the overall index: *de facto* and *de jure*, the former includes variables that represent globalization, while the latter includes others that enable it. We determined that the *de jure* social globalization dimension is more aligned with the social and cultural context that we want to control for. The *de jure* social globalization is composed by the following dimensions, grouped into three categories:

- Interpersonal globalization: Telephone subscriptions, visa requirements, international airports availability.
- Informational globalization: Television set ownership, press freedom, internet usage, capacity of international internet bandwidth.
- Cultural Globalization: Gender parity, expenditure on education, civil freedom.

4.2. Sample B

As seen in Table 1, for most variables there is data available up until 2016. This is not the case for Penn World Table data and the Research Expenditure variable. To make the most out of the dataset, we construct a second sample using imputed values for these variables. This way we can make use of the latest data available, while also increasing our sample size.

We used ARIMA methods developed by Box, Jenkins, Reinsel, and Ljung (2015) for forecasting each series. We didn't dabble with theories of causality for these variables because it's not in the main objective of this paper. Following the algorithm proposed by Hyndman & Khandakar (2008), below is the exact process of imputation for each country and series:

1. Select optimal differentiation order (d*) using the KPSS test (Kwiatkowski, Phillips, Schmidt, & Shin, 1992)
2. Select optimal autoregressive (p*) and moving average (q*) lags by minimizing the Akaike Information Criteria.
3. Compute the ARIMA (p*, d*, q*) estimates.
4. Forecast 2015 and 2016 values for Capital Stock, Employment, and Population; and 2016 values for Research and Development Expenditure.

[7] https://www.kof.ethz.ch/globalisation

4.3. *Methods and Procedures*

In order to determine whether the relationship between entrepreneurship and economic growth holds for different stages of economic growth. We use an extended version for the model proposed by Wong, Ho, and Autio (2005). Consequently, we use an approximate Cobb-Douglas production function as follows:

$$Y = A^{\circ} K^{\alpha} L^{1-\alpha} \tag{1}$$

Where Y represents the real gross domestic product, A° describes the disembodied factor productivity, K^{α} corresponds to the stock of capital and $L^{1-\alpha}$ is the total labor employed. All variables except labor are based on purchasing power parity.

Making equation (1) per-capita and taking both sides logarithms to get the elasticities, we have:

$$y_{it} = \vartheta_A ln A_{it} + \vartheta_k k_{it} + \vartheta_l l_{it} + \tau_{it} + \varepsilon_{it} \tag{2}$$

Where $y_{it} = \ln\left(\frac{Y}{N}\right)$; $k_{it} = \ln\left(\frac{K}{N}\right)$; $l_{it} = \ln\left(\frac{L}{N}\right)$

By last, taking first differences of equation (2) to get economic growth rates, we have:

$$\Delta y_{it} = \vartheta_A \Delta ln A_{it} + \vartheta_k \Delta k_{it} + \vartheta_l \Delta l_{it} + \tau_{it} + \varepsilon_{it} \tag{3}$$

We explain the growth in disembodied factor productivity (i.e. A°) as a function of innovation, institutions and knowledge changes. Innovation consists in the stock of knowledge capital (effective innovation) and entrepreneurship. Institutions is represented by the public institutions metric developed by WEF which compress: property rights, ethics and corruption, undue influence, public-sector performance, and security. By last knowledge collects the production process knowledge measured by the industry value added. It is true that industry value added could be a biased metric to the productive knowledge of a country, nonetheless, it captures the capability of a country to produce value at industrial level. To get a less biased measure, we control for the national natural resources rents index[8] developed by the World Bank. We hope that higher levels of productive knowledge improve economic growth.

The proposed variables to describe the disembodied productivity factors have been largely applied — separately — in the study of economic growth. Innovation has been included in both neoclassical (Solow, 1956) and endogenous Romer (1986) theories due to its importance to the technological innovation process. Entrepreneurship takes three possible values in this analysis: dynamic, regular and unipersonal. It is important to rescue that only dynamic entrepreneurship is closely related to the Schumpeterian view. As part of our analysis we aim to prove that not all entrepreneurship is leading to economic growth. We expect the impact of entrepreneurship measures to be different according the type. Regular entrepreneurship compresses the entrepreneurial proportion without high-expectation job creation. Dynamic plus regular conforms the TEA. By the other hand unipersonal is the complement to the proportion of

[8] Difference between the price of a commodity and the average cost of producing it. This index compresses the sum of oil, natural gas, coal (hard and soft), mineral and forest rents.

employers that are involved in self-employment activities to total of self-employment. Hence, we have the following metrics of entrepreneurship:

$$DE_{it} = \frac{Gazelle_{it}}{TEA_{it}} \times \frac{TEA_{it}}{POP_{it}} \tag{4}$$

$$RE_{it} = 1 - \frac{Gazelle_{it}}{POP_{it}} \tag{5}$$

$$UE_{it} = 1 - \frac{Employers_{it}}{Self - Employment_{it}} \tag{6}$$

We also use the metric of effective innovation. As mentioned before, several approaches are used to proxy innovation. In contrast to the used by Wong, Ho, and Autio (2005) who use innovation as patent grants to GDP, we propose that effective innovation measure could account in a better way the effects of knowledge innovation. Thus, we have.

$$EI_{it} = \frac{Patent\ Grants_{it}}{R + D_{it}} \tag{7}$$

Where patent grants represent patents produced by residents and non-residents; and R+D is the research and development expenditure as % GDP.

In short, we have:

$$\Delta lnA_{it} = \omega_i + \overbrace{\tau_1(Entrepreneurship_{it} + Effective\ Innovation_{it})}^{Innovation} + \overbrace{\tau_2 Public\ Institutions_{it}}^{Institutions} + \overbrace{\tau_3 Productive\ Knowledge}^{Knowledge} \tag{8}$$

4.4. *Econometric Strategy*

In this section the foundation for the empirical work is described. Our analysis is motivated due to the non-conclusive evidence in turn the effect of entrepreneurship for emerging countries, moreover, a certain direction effect has been unknown. We limited our analysis on the proposed temporal range window, because the construction of the panel involves GEM metrics which are available since 2000. The national conditions, the type and influence of entrepreneurship can vary between emerging and development economies. The empirical approach allows to account for the fact that the process of entrepreneurship could be different across countries and is shaped by country-specific factors.

Our panel estimates consist in two different specifications which differ by the use or non-use of controls that might influence the outcomes of economic performance and entrepreneurial activities. We also control for year fixed effects to capture the influence of macroeconomic factors over the proposed relationship. In particular, we explain economic growth as a function of entrepreneurial factors, predictors factors and productivity factors. We get:

$$\Delta y_{it} = \omega_i + y_{it-1} + \sum_{E=1}^{E} \delta_E \gamma_{it-1}^{E} + \sum_{P=1}^{P} \vartheta_P \gamma_{it}^{P} + \sum_{F=1}^{F} \varrho_F \gamma_{it}^{F} + \phi_{it} + \epsilon_{it} \tag{9}$$

Where entrepreneurial factors are the three measures presented before, predictor factors correspond to public institutions, effective innovation and productive knowledge and productivity factors are represented by capital per-capital and the employment rate, and ϕ_{it} is the indicator variable for each year. We clustered standard errors by country to allow correlation in the errors within countries across years. Note that entrepreneurial factors are lagged one period, this basically done due to the fact of entrepreneurship do not have an immediately effect over growth rates. It is also recommended by Wong, Ho, and Autio (2005). Additionally, to control for the convergence effect — detailed in Barro & Sala-i-Martin (1997) — where lower income countries have faster rates of economic growth than developed we include the base year per-capita GDP.

$$\Delta y_{it} = \omega_i + y_{it-1} + \sum_{E=1}^{E} \delta_E \gamma_{it-1}^{E} + \sum_{P=1}^{P} \vartheta_P \gamma_{it}^{P} + \sum_{F=1}^{F} \varrho_F \gamma_{it}^{F} + \sum_{C=1}^{C} \varrho_C \gamma_{it}^{C} + \phi_{it} + \epsilon_{it} \qquad (10)$$

Equation 10 holds the same base idea of our baseline specification (i.e. equation 9) but we incorporate a set of controls. Here, we account for socioeconomic and cultural factors as the suggested by Valliere and Rein (2009). We also capture the effect of investment level by the net foreign direct investment inflows and for the natural resources rents in the attempt to get the effect of productive knowledge and its relationship with economic growth.

By last, as mentioned in section **4.2** we replicate equation (9) and (10) with sample B. To get another idea about how the relationship is working. Nonetheless, results from sample B are only exploratory since we work with forecasted values. These results are showed in **Appendix C**.

5. Findings and Narrative of Results

Table 2 reports the results of these fixed-effects regressions with and without controls. Here, we intend to empirically answer the hypothesis developed in section **3**.

Table 2. Fixed effects estimation results

Dependent Δln gdp	Advanced				Emerging			
	GEM		World Bank		GEM		World Bank	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
Base year GDP	-0.147***	-0.143***	-0.123***	-0.129***	-0.049*	-0.046	-0.076**	-0.078**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.077)	(0.107)	(0.039)	(0.043)
Entrepreneurship								
Dynamic Entrepreneurship$_{t-1}$	0.407**	0.359*			0.437*	0.431*		
	(0.031)	(0.053)			(0.054)	(0.077)		
Regular Entrepreneurship$_{t-1}$	-0.139*	-0.116			0.0620	0.053		
	(0.067)	(0.103)			(0.566)	(0.637)		
Unipersonal Entrepreneurship$_{t-1}$			0.146***	0.136***			0.048	0.072
			(0.001)	(0.005)			(0.405)	(0.222)
Other Predictors								
Effective Innovation	0.016***	0.014***	0.00936	0.00917	0.009	0.009	0.007**	0.007**
	(0.002)	(0.002)	(0.200)	(0.219)	(0.271)	(0.301)	(0.047)	(0.039)
Public Institutions	0.055**	0.059**	0.042*	0.049**	0.014	0.008	0.019	0.012
	(0.024)	(0.011)	(0.071)	(0.035)	(0.619)	(0.843)	(0.418)	(0.668)
Productive Knowledge	0.106***	0.109***	0.127***	0.125***	0.010	0.0192	0.054*	0.044
	(0.003)	(0.002)	(0.000)	(0.000)	(0.895)	(0.821)	(0.094)	(0.289)
Productivity Factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	274	271	419	404	131	128	256	245
Countries	34	33	36	35	27	26	36	35

Notes: Columns (1) correspond to equation (1); Columns (2) correspond to equation (2). Clustered standard errors of estimated coefficients are in brackets. ***, **, * indicates the significance at 1%, 5%, 10% confidence level respectively. All variable except entrepreneurial activity are in logs. It includes year dummies for the period 2001 – 2014. Productivity factors contains per-capital capital and employment rate $\left(\frac{L}{N}\right)$. Controls include investment, social globalization and natural resources rents. Base year GDP refers to gdp_{t-1}.

An extended version of Table 2 is presented in the **Appendix C.**

First, we have found consistent results of the base year GDP since its negative direction effect. This suggests that a convergence effect exists. As proposed in our hypothesis, we found that all measures of entrepreneurial activity except regular entrepreneurship have positive effects on economic growth. It is specifically true for advanced economies. By the other hand for emerging economies, only the dynamic part of entrepreneurial activities is related to growth rates changes. This result gives empirical evidence to the relationship between entrepreneurship and growth for different stages of economic development.

Conversely to the work of Valliere and Rein (2009) who did not find evidence to the studied relationship for emerging countries. This result suggest that public policies should be orientated to this type of entrepreneurship specially for emerging countries. On the other hand, we also show that regular entrepreneurship does not affect economic growth. According to this, it is possible to mention that not all entrepreneurship is "good" for advanced and emerging economies. This is could be an answer to the puzzle of entrepreneurship. Emerging economies have the higher rates of entrepreneurial activities, but this may be being motivated by unemployment or the economic cycle where at bad stages of the economy people need to obtain economic resources typically undertaking in something. Here, the maturity and persistence of entrepreneurship play an important role.

For advanced economies, effective innovation was found significant when the entrepreneurial construct is measured by the dynamic part suggesting that there is a relationship between dynamic as a source of innovation and effective produced innovation. Contrariwise, when unipersonal entrepreneurship is included for the analysis, the effect gets dissolved. For the emerging countries is the opposite. There is no relationship of effective innovation when we include dynamic entrepreneurship but there is when unipersonal entrepreneurship is studied. This disparity recommends that entrepreneurship and innovation are not specifically in the same line. This in part is a support for the idea of Wong, Ho, and Autio (2005). Thus, our innovation hypothesis is supported.

It is predominantly true the fact of having a higher rate of productive knowledge improves economic growth for advanced economies. This idea is not far from reality since emerging countries industry is not well developed. We did not find evidence between productive knowledge and economic growth for emerging economies. By last, the case of institutions is closely similar to the results for productive knowledge. We have found a positive and significant effect only in advanced economies. This advocate that emerging countries face a challenge in terms of: property rights, ethics and corruption, undue influence, public-sector performance, and security.

6. Conclusions

Many governments (specially in developing countries) have developed special programs to encourage entrepreneurship, hoping it will contribute to growth, employment, and economic welfare. There is an open debate on the actual effect of entrepreneurship on

economic variables, especially in developing countries where entrepreneurship has a strong component based on necessity. Furthermore, it is difficult to identify the "type" of entrepreneurship that public policy should foster. This work aims to partially answering this question by analyzing data for 100 countries over a 16 year-period sample. Entrepreneurship can be a source of growth both for developed and developing countries.

However, not *all* entrepreneurship has this effect. Dynamic (or high-growth) entrepreneurship has a significant effect in economic growth both in advanced economies as in emerging markets. It is particularly interesting the result for emerging markets, where typically entrepreneurship has been associated with small, low-growth ventures. This result should encourage public policies that promote the development and financing of dynamic entrepreneurs through a more mature entrepreneurial ecosystem.

This paper also contributes to the literature by measuring a concrete relationship between entrepreneurship and innovation – and specifically a different one for emerging and for advanced countries. This result should lead to a rethinking of innovation policies in emerging markets.

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7.1. Appendix A

Table A1. List of countries and their development level

Emerging	Advanced
Argentina	Australia
Bosnia and Herzegovina	Austria
Botswana	Belgium
Brazil	Canada
Chile	Croatia
China	Czech Republic
Colombia	Denmark
Costa Rica	Estonia
Ecuador	Finland
El Salvador	France
Georgia	Germany
Guatemala	Greece
India	Hungary
Kazakhstan	Ireland
Latvia	Israel
Mexico	Italy
Pakistan	Japan
Panama	Lithuania
Peru	Luxembourg
Philippines	Malaysia
Romania	Netherlands
South Africa	Norway
Thailand	Poland
Turkey	Portugal
Uruguay	Saudi Arabia
	Singapore
	Slovenia
	Spain
	Sweden
	Switzerland
	Trinidad and Tobago
	United Arab Emirates
	United Kingdom
	United States

Breakpoint: Avg. GDP per capita = 20,000 USD

Table A2: Descriptive statistics

Variable	Advanced					Emerging				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
TEA	371	0.07	0.03	0.01	0.23	265	0.16	0.09	0.02	0.50
Dynamic Entrepreneurship	371	0.17	0.09	0.00	0.59	265	0.14	0.09	0.01	0.48
Capital	546	3.69	7.90	0.00	52.85	686	1.81	5.91	0.00	69.38
Labor	534	12.94	25.03	0.01	148.46	686	40.25	125.84	0.09	798.37
Population	546	27.23	52.01	0.01	319.45	686	90.18	247.07	0.25	1369.44
GDP	585	39.54	19.94	11.19	129.35	770	9.28	5.40	0.61	23.59
FDI	568	6.52	16.81	-58.32	252.31	767	3.91	3.95	-8.40	31.00
Industry	575	33.05	19.17	6.84	213.69	734	30.36	9.07	10.17	64.88
Self-Employment	588	4.44	2.40	0.18	19.28	756	3.82	3.01	0.19	18.43
Employers	588	16.20	8.52	0.41	50.65	756	46.01	21.44	10.28	92.62
$R+D	507	1.68	1.01	0.03	4.41	391	0.44	0.33	0.01	2.02
Natural Resources	585	5.06	11.29	0.00	63.49	770	7.58	8.95	0.00	59.94
Public Institutions	555	5.02	0.89	2.57	6.60	642	3.80	0.70	1.80	5.77
Social Globalization	532	79.38	10.11	35.65	93.02	700	60.10	14.52	20.72	91.75
Patents	488	21.08	52.32	0.00	343.53	438	2.53	15.64	0.00	176.35

7.2. Appendix B

Table B1 Countries and years: sample using GEM variables.

Development level	Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Advanced	Australia		X		X		X				X	X			
	Austria					X		X					X		X
	Belgium		X	X		X	X	X	X	X	X	X	X	X	X
	Canada													X	X
	Croatia		X	X	X	X	X	X	X	X	X	X	X	X	X
	Czech Republic						X					X		X	
	Denmark	X	X	X	X	X	X	X	X	X	X	X	X		X
	Estonia												X	X	X
	Finland	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	France	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Germany	X	X	X	X	X	X		X	X	X	X	X	X	X
	Greece			X	X	X	X	X	X	X	X		X	X	X
	Hungary	X	X		X	X	X	X	X	X	X	X	X	X	X
	Ireland	X	X	X	X	X	X	X	X		X	X	X	X	X
	Israel		X					X	X	X	X		X	X	
	Italy							X	X	X	X		X	X	X
	Japan	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Lithuania											X	X	X	X
	Luxembourg														X
	Malaysia						X			X	X	X	X		X
	Netherlands	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Norway	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Poland	X	X		X							X	X	X	X
	Portugal	X			X			X			X	X	X	X	X
	Saudi Arabia										X				
	Singapore	X	X	X	X	X	X					X	X	X	X
	Slovenia		X	X	X	X	X	X	X	X	X	X			
	Spain	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Sweden	X		X	X	X	X	X			X	X	X	X	X
	Switzerland												X		
	Trinidad and Tobago												X	X	X
	United Arab Emirates											X			
	United Kingdom	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	United States	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Emerging	Argentina	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Bosnia and Herzegovina								X				X	X	
	Botswana												X	X	
	Brazil	X	X			X	X		X	X	X	X	X	X	X
	Chile							X	X	X	X	X	X	X	X
	China		X	X		X	X	X		X	X	X	X	X	X
	Colombia						X	X	X		X	X	X	X	X
	Costa Rica										X		X		X
	Ecuador													X	
	El Salvador												X		X
	Georgia														X
	Guatemala									X	X	X			
	India	X	X				X	X	X						
	Kazakhstan														X
	Latvia					X	X				X	X	X	X	
	Mexico	X	X			X	X		X		X	X	X	X	X
	Pakistan											X			
	Panama									X		X	X	X	
	Peru				X							X	X	X	X
	Philippines													X	
	Romania							X	X	X	X	X	X	X	X
	South Africa	X		X	X	X	X		X	X	X	X	X	X	
	Thailand		X			X	X	X				X		X	X
	Turkey						X	X	X			X	X	X	
	Uruguay								X	X	X	X	X		X

Table B2. Countries and years: sample using World Bank's employment indicators

Development level	Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Advanced	Australia		X		X		X		X		X	X		X	
	Austria	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Belgium		X	X		X	X	X	X	X	X	X	X	X	X
	Canada							X	X	X	X	X	X	X	X
	Croatia		X	X	X	X	X	X	X	X	X	X	X	X	X
	Cyprus				X	X			X	X	X	X	X	X	
	Czech Republic	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Denmark	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Estonia	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Finland	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	France	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Germany	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Greece	X		X	X	X	X	X	X	X	X		X	X	X
	Hungary	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Ireland	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Israel	X	X	X			X	X	X	X	X	X	X	X	X
	Italy							X	X	X	X	X	X	X	X
	Japan	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Lithuania	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Luxembourg			X		X	X	X	X	X	X	X	X		X
	Malaysia		X		X		X		X	X	X	X	X		X
	Netherlands	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Norway	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Poland	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Portugal	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Saudi Arabia							X			X	X		X	
	Singapore	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Slovenia	X	X	X	X	X	X	X	X	X	X	X			
	Spain	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Sweden	X		X	X	X	X	X	X	X	X	X	X	X	X
	Switzerland				X				X				X		
	Trinidad and Tobago						X	X	X				X	X	X
	United Arab Emirates											X			X
	United Kingdom	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	United States	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Emerging	Algeria			X	X										
	Argentina	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Bosnia and Herzegovina				X	X	X		X				X	X	
	Botswana												X	X	
	Brazil	X	X			X	X		X	X	X	X	X	X	X
	Bulgaria	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Burkina Faso									X					
	Chile							X	X	X	X	X	X	X	X
	China	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Colombia	X	X	X	X	X	X	X	X		X	X	X	X	X
	Costa Rica										X	X	X	X	X
	Ecuador		X					X						X	
	El Salvador												X	X	X
	Ethiopia					X		X							
	Georgia				X	X								X	X
	Guatemala					X		X	X	X	X	X	X		
	India	X	X	X	X	X	X	X	X	X	X	X			
	Jamaica	X	X												
	Jordan		X						X						
	Kazakhstan								X	X	X	X		X	X
	Latvia	X	X	X	X	X	X				X	X	X	X	X
	Mexico	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Morocco						X				X				
	Pakistan					X		X				X		X	
	Panama								X	X	X	X	X	X	
	Peru	X	X	X	X							X	X	X	X
	Philippines		X	X		X		X		X		X		X	
	Romania	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Senegal										X				
	South Africa	X		X	X	X	X	X	X	X	X	X	X	X	
	Thailand	X	X	X	X	X	X	X	X	X		X		X	X
	Tunisia											X		X	
	Turkey	X	X	X	X	X	X	X	X	X		X	X	X	X
	Uruguay		X						X	X	X	X	X		X
	Zambia			X	X										

7.3. Appendix C

Table C. Extended regression results

Dependent Δln gdp	Advanced								Emerging							
	Sample A				Sample B				Sample A				Sample B			
	GEM		World Bank		GEM		World Bank		GEM		World Bank		GEM		World Bank	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
GDP_{t-1}	-0.147***	-0.143***	-0.123***	-0.129***	-0.132***	-0.143***	-0.111***	-0.129***	-0.049*	-0.046	-0.076**	-0.078**	-0.044**	-0.046	-0.072**	-0.078**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.077)	(0.107)	(0.039)	(0.043)	(0.043)	(0.107)	(0.011)	(0.043)
Productivity Factors																
Δln Capital	0.010	0.005	0.026	0.026					0.172**	0.123**	0.102***	0.090***				
	(0.661)	(0.832)	(0.281)	(0.306)					(0.028)	(0.019)	(0.003)	(0.002)				
Δln Labor	0.341***	0.330***	0.450***	0.451***					0.580***	0.564***	0.236**	0.239**				
	(0.000)	(0.000)	(0.001)	(0.001)					(0.009)	(0.005)	(0.030)	(0.035)				
Δln Forecasted Capital					0.011	0.005	0.029	0.025					0.127*	0.123**	0.094***	0.090***
					(0.618)	(0.832)	(0.200)	(0.306)					(0.057)	(0.019)	(0.005)	(0.002)
Δln Forecasted Labor					0.344***	0.330***	0.457***	0.451***					0.570***	0.564***	0.248**	0.239**
					(0.000)	(0.000)	(0.000)	(0.001)					(0.008)	(0.005)	(0.020)	(0.035)
Entrepreneurship																
$Gazelle_{t-1}$	0.407**	0.359*			0.477***	0.359*			0.437*	0.431*			0.266	0.431*		
	(0.031)	(0.053)			(0.005)	(0.053)			(0.054)	(0.077)			(0.105)	(0.077)		
$Regular\ Entrepreneurship_{t-1}$	-0.139*	-0.116			-0.146**	-0.116			0.0620	0.053			0.038	0.0528		
	(0.067)	(0.103)			(0.043)	(0.103)			(0.566)	(0.637)			(0.637)	(0.637)		
$Unipersonal\ Entrepreneurship_{t-1}$			0.146***	0.136***			0.117***	0.136***			0.048	0.072			0.051	0.072
			(0.001)	(0.005)			(0.004)	(0.005)			(0.405)	(0.222)			(0.332)	(0.222)
Other Predictors																
Effective Innovation	0.016***	0.014***	0.00936	0.00917					0.009	0.009	0.007**	0.007**				
	(0.002)	(0.002)	(0.200)	(0.219)					(0.271)	(0.301)	(0.047)	(0.039)				
Forecasted Effective Innovation					0.014***	0.014***	0.007	0.009					0.002	0.009	0.007**	0.007**
					(0.008)	(0.002)	(0.271)	(0.219)					(0.683)	(0.301)	(0.014)	(0.039)
Public Institutions	0.055**	0.059**	0.042*	0.049**	0.044**	0.059**	0.037*	0.049**	0.014	0.008	0.019	0.012	0.042	0.008	0.017	0.012
	(0.024)	(0.011)	(0.071)	(0.035)	(0.040)	(0.011)	(0.069)	(0.035)	(0.619)	(0.843)	(0.418)	(0.668)	(0.158)	(0.843)	(0.366)	(0.668)
Productive Knowledge	0.106***	0.109***	0.127***	0.125***	0.097***	0.109***	0.111***	0.125***	0.010	0.0192	0.054*	0.044	0.040	0.019	0.057**	0.044
	(0.003)	(0.002)	(0.000)	(0.000)	(0.001)	(0.002)	(0.000)	(0.000)	(0.895)	(0.821)	(0.094)	(0.289)	(0.485)	(0.821)	(0.034)	(0.289)
Controls																
FDI		0.002		-0.001						0.025***		0.013**				
		(0.168)		(0.225)						(0.008)		(0.020)				
Forecasted FDI						0.002		-0.001						0.025***		0.013**
						(0.168)		(0.225)						(0.008)		(0.020)
Social Globalization		-0.033		0.020		-0.033		0.020		-0.059		0.013		-0.059		0.013
		(0.508)		(0.671)		(0.508)		(0.671)		(0.561)		(0.857)		(0.561)		(0.857)
Natural Resources		0.004**		0.002		0.004**		0.002		0.004		0.003		0.004		0.003
		(0.048)		(0.262)		(0.048)		(0.262)		(0.824)		(0.749)		(0.824)		(0.749)
Other Controls																
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	274	271	419	404	317	271	471	404	131	128	256	245	154	128	286	245