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Mediating role of research and development on entrepreneurial activities and growth

Evidence from cross-country data

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Abstract

Purpose – The purpose of this paper is to investigate to what extent the level of human development affects the relationships between entrepreneurial activities (EAs) and total factor productivity (TFP). The paper's objectives are threefold. First, it seeks to examine the effect of EA on TFP. Second, it attempts to test for the moderating effect of human development on the relation between EA and TFP, using the generalized methods of moments (GMM), in a panel data across two groups of countries based on their human development index during the period 2000-2008. Third, it tests the causality between TFP, EA, research and development (R&D), unemployment and inflation across countries.
Design/methodology/approach – Cross-countries study using a panel GMM for two groups of countries based on their human development index during the period 2000-2008.
Findings – Empirical evidence provides that EA have a positive significant relation across countries on TFP in the higher human development levels. The outcomes point toward the role of policies supporting EA as a vital tool to accelerate development and growth via channels such as: better education levels, enhancing R&D, creating more jobs, and stable monetary policy.
Research limitations/implications – From the paper limitation is it focusses only on very high human and high human development countries and not studying medium and low-development countries but this limitation is refereed to source of the entrepreneurship data.
Practical implications – This paper provides a comparative analysis of the empirical results and presents prospective explanations for the observed relationships between different groups of countries to study the dynamics of change with relative short time series.
Originality/value – The study is of value for policy makers of the important relation between levels of development among countries as engine to growth via EA. Moreover, the findings provide a set of policies for governments to undertake tenable actions to accelerate the effectiveness of the institutional setting.

Keywords Entrepreneurship, Sustainable development

Paper type Research paper

1. Introduction

Empirical studies tried to assess the relationship between entrepreneurship and economic growth which is a mysterious relation across countries. This vague link attracts researchers to uncover these direct and indirect factors affecting entrepreneurial activities (EAs).

This research investigates these missing links across countries and the spillover factors responsible for accelerating productivity and growth. EAs have been studied and explained by prominent economists making the notion even more complicated and less clear. There are several classifications to entrepreneurs; among them is the

JEL Classifications — C13, O47

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distinction between innovative and "replicative" entrepreneurs. The latter are important in poverty alleviation, employment creation, welfare (Tamvada, 2009), and income inequality Kimhi (2009). The effects of entrepreneurship can be easily measured on a micro-level in individuals' activities. However, it is more challenging to measure its effects on a macro scale. Challenges arise in determining the reliable measures for entrepreneur's activities. In this arena, several proxies are being used to measure entrepreneurship such as business ownership rate, entry rate, self-employment rate but none of them is a synonym to entrepreneur's activities.

Entrepreneurs, especially innovative ones, are linchpin to the process of development (Schumpeter, 1912). The study's contribution is based on finding the links between entrepreneur's activities, total factor productivity (TFP) across countries based on classifying countries according to their human development index. The human development index[1] is a comparative measure of life expectancy, literacy, education, standard of living, and quality of life for countries worldwide.

The study is of value for policy makers of the important relation between levels of development among countries as an engine to growth via EA. Moreover, the findings provide a set of policies for governments to undertake tenable actions to accelerate the effectiveness of the institutional setting. The structure of the paper is designed as follows; Section 2 overview literatures. Section 3 describes the model, data and variables used in this study, Section 4 presents the empirical results of our analyzes and Section 5 concludes the main points of the paper.

2. Literature overview

2.1 Definition of the EAs

Economists and scholars including Adam Smith Jean Baptiste Say, Alfred Marshall, and Frank Knight elaborated Cantillon's contribution, adding leadership and recognizing entrepreneurship, through organization, as a fourth factor of production. Theoretically, Schumpeter (1912) defines entrepreneurs, especially innovative ones, as the linchpin to the process of development. In his model, an entrepreneur is seen as an agent, who through the process of innovation, brings about social change and economic development. Furthermore, he distinguishes five manifestations of entrepreneurship, the introduction of a new (or improved) product; the introduction of a new method of production; the opening of a new market; the exploitation of a new source of supply; and the re-engineering/organization of business management processes. Schumpeter's definition, therefore, equates entrepreneurship with innovation in the business sense; that is identifying market opportunities and using innovative approaches to exploit them. A brief definition of the entrepreneur is listed in Table AI.

In 1999 Wennekers and Thurik have developed a definition that seems to encompass the characteristics of entrepreneurship as follows: "Entrepreneurship is the manifest ability and willingness of individuals whether on their own, or in teams, within and outside existing organizations, to perceive and create new economic opportunities"[2]. EA is the enterprising human action in pursuit of the generation of value, through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets. EA includes the entry of new markets, the creation of new products or services, and/or the innovation associated with different business activities (new markets, new capabilities, and new products/services). EA can therefore be associated with organic as well as acquisitive decisions. The essential question relates to whether the activity involves new entry and activity.

Second, EA does not include those people considering or planning EA. Such phenomena would be considered in relation to cultural or socio-cultural analysis, which may indeed impact EA indirectly. The definitions adopted in this paper do not measure those "considering" EA, nor does it differentiate between entrepreneurs in new or old ventures. Third, entrepreneurs require investment to establish a business.

2.2 EAs and TFP

A direct measurement of contribution to a country's GDP is a firm's value added, and the efficiency of production or the contribution to GDP per worker, i.e. labor productivity. TFP is used as the final indicator. It is often referred to as the "residual" or the indicator of "technical progress" and it is defined as output per unit of capital and labor combined. Since 1978, Lucas provided a considerable number of papers that used a production function approach which explicitly includes "variables for entrepreneurial ability" in the model for the TFP and the assumption of decreasing returns to scale (e.g. Holtz-Eakin *et al.*, 1994; Dunn and Holtz-Eakin, 2000; Gentry and Glenn Hubbard, 2000).

Furthermore, a group of researchers (Coe and Helpman, 1995; Engelbrecht, 1997; Griffith *et al.*, 2004; Guellec and Van Pottelsberghe de la Potterie, 2004) examined the drivers of productivity and incorporated entrepreneurship to these models. The data included 20 OECD countries for 32-year period (1971-2002). Entrepreneurship was measured as the ratio between actual and equilibrium business ownership rates. Their findings confirmed the results of the five seminal studies as public and private research and development (R&D), human capital, technology, and other significant variables are drivers of TFP. In addition, they showed that entrepreneurship has a significant impact on TFP (Erken *et al.*, 2008). Moreover, Thurik *et al.* (2008) related the growth of the number of business owners as a percentage of the labor force to (national) GDP growth. The use of entrepreneurship proxy to explain productivity is linked to the role of economic development. The negative relationship between business ownership and economic development is examined (Kuznets, 1971; Yamada, 1996). Further, scholars demonstrated that institutional structure such as; culture, legal environment, economic incentives, and traditions influence the development of industries and the success of entrepreneurial firms within industries (Aldrich and Fiol, 1994; Baumol *et al.*, 2007).

The potential determinants of entrepreneur are several and cover a wide range of theories. This wide spectrum of approaches is referred to the overlapping role of entrepreneur. Literature differentiates between the levels of analysis, at the micro level researchers focal point on the decision making process by individuals to become self-employed, (Reynolds *et al.*, 1999; Blanchflower and Oswald, 1998). While, on the macro level entrepreneurship, determinants are explained by demand side factors (named push factors) and supply side factors (named pull factors), Push factors, or the demand side factors represent technological developments, industrial structure of the economy, government regulation, and the stage of development. These driving forces are representing the entrepreneurship demand (OECD, 1996; Wennekers and Thurik, 1999; Wennekers *et al.*, 2002).

On the other hand, it has been argued that technological developments retard the level of entrepreneurship, reasoning that the technological development may or may not create a barrier for new entry to the business. Researchers found that technological developments are considered to be one of the driving forces in the demand for entrepreneurship (OECD, 1996; Wennekers and Thurik, 1999; Wennekers *et al.*, 2002).

In this paper, the measure to technological development is based on the expenditure on R&D.

The importance of productivity attributes to set a sound governmental policies, transparent institutional structure, and wealth to generate EAs which are the sources of development and economic growth. Thus, adopting policies to promote knowledge and improve labor skills to encourage entrepreneur activities, particularly through fiscal policies, is a long-term plan. Researchers suggested a general framework for achieving a sound economic setting. This setting passed through the following stages: Stage 1 focusses on attracting the innovate entrepreneurs – this stage represents the resource availability stage. Stage 2 is a start up stage, which concerns with the executive implementation of the determinants productivity. As for the Stage 3, it is a take off stage; this is based on R&D and ICT as a pillar for the dynamism of growth that can lead to development (Salman and Badr, 2011).

Finally, from the core determinants comes the institutional setting, such as size of the government, the degree of administrative complexity, the tax system, the intellectual property rights regime, the level of trust, corruption, and availability of finance capital. All can affect the level of entrepreneurship in a country. Bureaucracy costs and regulations affect EAs. In the study of OECD countries, fewer individuals become entrepreneurs when the start up cost is high, Fonseca *et al.* (2001). Related empirical studies find that well defined rules and regulations, well-protected rights, sound government, less corruption and efficient judicial system promote entrepreneurship (Morck *et al.*, 2000; Johnson *et al.*, 2000, 2002). In this paper the overall economic freedom index is employed as a proxy for institutional.

According to Henriquez *et al.* (2001), the level of tax system negatively affects the level of entrepreneurship. Moreover, Henrekson (2005) points out that higher rates of personal taxation discourage the market provision of goods and services that substitute closely the home-produced services. In this paper, the total tax rate (percent of commercial profits) is employed to capture the effect of taxes on EAs.

More importantly, researchers suggest that a firm's investment decisions are highly sensitive to the country's institutions and policies. Such policies, by affecting the business climate, can either promote or deter firms' willingness to enter or stay in the market. The volatile macroeconomic policies increase the financial risk and raise the risks of using financial hedging instruments. McMillan and Woodruff (2002) suggests that the volatility in macroeconomic policies causes discourage long term contracts and relations which is necessary for EAs. Thus, volatile macroeconomic policies may be negatively affecting entrepreneurship. In this paper, the average GDP deflator is employed to capture the volatility of monetary policies.

3. Methodology and data

3.1 Methodology

In the growth accounting process, TFP plays an important role as one of the leading factors in accelerating GDP growth. Thus, this paper uses a panel data for two groups. The reason for this classification is that countries differ in the constraints under which they operate: namely physical resources, including capital, human resources, technologies, access to markets, and foreign debt. All of this means that countries with different levels of human development can achieve future goals of per capita income and satisfying people's demands. Consequently, this paper groups countries according to their human development index during the period 2000-2008. Group 1

includes 31 countries and their human development index is above 90 percent, Group 2 includes 31 countries and their human development index is above 80 percent. A list of for the countries under study is given in Table AII.

Continuing with the above discussion, it is now proper to identify the impact of EAS on TFP. To do so, it requires first to calculate TFP for each country in the two groups under study. Separate analyses are carried out, ultimately leading to an estimated effect of EA on TFP for each group. This allows for a comparison of these effects. Second is to predict the entrepreneurial variable for each country in the two groups under study. Finally is to use the calculated TFP (as dependent variable) with the set of explanatory variables. Empirical growth accounting exercise uses the aggregate neoclassical production function to decompose the growth rate of aggregate output into contributions of growth of measured inputs and improvements in TFP. To specify an aggregate production function, it is represented as follows:

$$Y\,t = A t f\,(K\,t,\, L\,t) \tag{1}$$

where "Y", "K" and "L" are output (GDP), capital and labor respectively, and "A" is the level of productive efficiency, the so-called TFP. To obtain the growth rate of output decomposed into sources of growth: improvement in productive efficiency ($\frac{\dot{A}}{A}$) and increase in factor inputs ($\frac{\dot{K}}{K}$) and $\frac{\dot{L}}{L}$. Differentiating equation one with respect to time and simplifying:

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \frac{Bf\dot{k}K}{Y}\frac{\dot{K}}{K} + \frac{Bf\dot{l}K}{Y}\frac{\dot{L}}{L} \tag{2}$$

Bfk and *Bfl* are the marginal products of capital and labor, respectively, which are equal to the rental and wage rates if markets are competitive and firms maximize their profits. Then, *Bfk K/Y* and *Bfl L/Y* are the shares of compensation to capital (α *K*) and labor (α *L*) in total output, respectively. Since the share of capital income is one minus the share of labor income under the assumption of constant returns to scale, the growth rate of output is decomposed into TFP growth and the weighted sum of the growth of capital and labor is as follows:

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + (1 + \alpha_l)\frac{\dot{K}}{K} + \alpha_l\frac{\dot{L}}{L} \tag{3}$$

Having data on the growth rates of output and input along with factor income shares, it can measure TFP growth from the above equation as residual output growth, after subtracting the contribution of measured input growth from output growth. Therefore, the above expression can be presented in the following equation:

$$\frac{\dot{A}}{A} = \frac{\dot{Y}}{Y} - (1 - \alpha_l)\frac{\dot{K}}{K} - \alpha_l\frac{\dot{L}}{L} \tag{4}$$

Second, the entrepreneurs' index (ENT) is estimated by regressing business entry on the cost of starting business (percent of GNI/Capita), time to start business, trade (percent of GDP), and number of trademarks registered. It is the residuals values from the regression.

3.2 Data

TFP, as dependent variable is estimated with the set of explanatory variables, data are extracted from World Development indicators 2010. Specification of the model is presented in Table I, by the following equation:

$$\mathrm{TFP} = \beta_0 + \beta_1 \mathrm{ENT} + \beta_2 \mathrm{RD} + \beta_4 \mathrm{UEMP} + \beta_5 \mathrm{INF} + \varepsilon \quad (5)$$

This study examine the correlation between the EAs, R&D, unemployment, and inflation with TFP using the GMM approach, to estimate the relation between TFP and ENTER across countries. In the following part a unit root test is applied to test stationarity, followed by co-integration test and estimating the variables using GMM methods, as follows.

Unit root tests. Unit root tests are important to test the variable stationarity involved in the research conducted. The variables' properties need to avoid the possibility of spurious regressions. In order to assess the stationary of the variables employed, this paper employs five different unit root tests including LLC's test (Levin *et al.*, 2002), Breitung's (2000) *t*-statistic, IPS-*W*-statistic (Im *et al.*, 2003), Augmented Dickey-Fuller (ADF)-Fisher χ^2 (Dickey and Fuller, 1979), and PP-Fisher χ^2 tests (Phillips and Perron, 1988).

Panel co-integration analysis. To determine whether the regressions are spurious, the results of the panel co-integration tests must be examined. Given the results, it is appropriate to test the co-integrating relationship between the three variables. This paper employs Pedroni's (2004) co-integration tests.

Granger causality test. The purpose of the granger causality test is to determine the causality among the variables. Although a panel co-integration test is conducted, it does not indicate the direction and helps to verify whether change in any variable can be explained by the other variables.

Generally, the GMM technique developed by Arellano and Bond (1991) can be adapted to estimate the panel variables, using lags of the endogenous variables as instruments in order to arrive to unbiased and consistent estimates of the coefficients. In a panel of n countries covering t years, this approach estimates the model parameters directly from the moment conditions that are imposed by the model.

Variable	Description	Definition
Dependent variable		
TFP	Total factor productivity	TFP is measures by a growth as a residual output growth, after subtracting the contribution of measured input growth from output growth
Independent variables		
ENT	Entrepreneurial activity	Is estimated by regressing business entry on the cost of starting business (percent of GNI/Capita), time to start business, trade (percent of GDP), and number of trademarks registered
RD	Research and development expenditures	Research and development expenditure (percent of GDP)
UNEMP	Unemployment	Unemployment, total (percent of total labor force)
INF	Inflation	GDP deflator (annual percent)

Table I.
Variables description

The great advantage of GMM is that it does not require distributional assumption, like normality; it can allow for heteroscedasticity of unknown form, and it can estimate parameters even if the model cannot be solved analytically from the first-order condition.

4. Results and discussions

The results of unit root tests for these five different unit root tests are reported in Table II indicating that the statistics significantly confirm that the first difference value of all series is stationary. Groups 1 and 2 show that all variables are stationary in the first level for all test except ENTER is stationary using LLC's test.

Panel co-integration analysis

This paper employs Pedroni's (2004) co-integration tests. As shown in Table III, the results of Pedroni's (2004) heterogeneous panel tests indicate that the null of no co-integration cannot be accepted at the 1 percent significance level except for the panel PP statistic and the group PP-statistic.

Results in Table III report the results of Pedroni's (2004) co-integration panel co-integration tests, which also reject the null of no co-integration at the 5 percent significance level, Group 2.

Granger causality test

The resulting equations are used in conjunction with panel Granger causality testing showed that entrepreneur can influence TFP and inflation in the short run dynamics and the computed *p*-value is significant at 1 percent, the null hypothesis cannot be rejected, since the TFP does not influence EAs (for Group 1) (Table IV).

Method	Dependent variable TFP	Independent variables ENTER	UNEMPL	INFL	RD
Group 1					
LLC-*t**					
First difference	−7.84075***	−6.08469***	−9.99406***	−8.62653***	−11.4262***
IPS-*W* stat.					
First difference	−2.56033**	−1.19638	−2.87924**	−3.59341***	−3.85903***
ADF-Fisher χ^2					
First difference	95.9777**	46.6105	90.9863**	119.069***	94.9962***
PP-Fisher χ^2					
First difference	116.391***	61.2566*	94.2621**	134.628***	124.544***
Group 2					
LLC-*t**					
First difference	−139.926***	4.26063***	−241.477***	−15.0402***	−20.2529***
IPS-*W* stat.					
First difference	−104.486***	na	−54.6689***	−3.81233***	−5.38639***
ADF-Fisher χ^2					
First difference	494.553***	23.8748	261.014***	115.270***	93.9813***
PP-Fisher χ^2					
First difference	515.963***	32.6772	304.602***	129.153***	108.324***

Table II.
Panel unit root test results

Notes: LLC, IPS, ADF-Fisher and PP-Fisher examine the null hypothesis of non-stationary. ***Statistical significance at the 1 percent level

	Statistic	Prob.	Weighted statistic	Prob.
Group 1				
Alternative hypothesis: common AR coefs. (within-dimension)				
Panel *v*-statistic	−1.314766	0.9057	−2.048336	0.9797
Panel *ρ*-statistic	2.743930	0.9970	2.229981	0.9871
Panel PP-statistic	−0.277532***	0.3907	−7.170222	0.0000
Panel ADF-statistic	−0.266321***	0.3707	−7.140322	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)				
Group *ρ*-statistic	3.687843	0.9999		
Group PP-statistic	−8.630081***	0.0000		
Group ADF-statistic	−9.310052***	0.0000		
Group 2				
Alternative hypothesis: common AR coefs. (within-dimension)				
Panel *v*-statistic	−2.414766	0.8056	−1.048336	0.8797
Panel *ρ*-statistic	3.643930	0.8970	1.229981	0.9871
Panel PP-statistic	−0.27753***	0.2807	−5.160111	0.0000
Panel ADF-statistic	−0.35564***	0.2607	−4.150222	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)				
Group *ρ*-statistic	2.587843	0.7777		
Group PP-statistic	−7.630081***	0.0000		
Group ADF-statistic	−7.510071***	0.0000		

Notes: The null hypothesis is that the variables are not co-integrated. Under the null tests, all variables are distributed normal (0, 1). *,**,***Statistical significance at 1, 5 and 10 percent levels, respectively

Table III.
Pedroni's residual co-integration test results (TFP)

Null hypothesis	*F*-statistic	Prob.	Remarks
Group 1			
ENTER does not Granger Cause TFP1	8.75411***	0.0003	Causality exists
TFP1 does not Granger Cause RD	8.16434***	0.0004	Causality exists
UNEMPL does not Granger Cause TFP1	6.71140**	0.0015	Causality exists
TFP1 does not Granger Cause UNEMPL	9.43089***	0.0001	Causality exists
INFL does not Granger Cause TFP1	5.44687**	0.0050	Causality exists
TFP1 does not Granger Cause INFL	5.75610**	0.0037	Causality exists
ENTER does not Granger Cause INFL	3.65217*	0.0290	Causality exists
INFL does not Granger Cause RD	6.06797**	0.0030	Causality exists
RD does not Granger Cause INFL	4.63891*	0.0112	Causality exists
INFL does not Granger Cause UNEMPL	3.07918*	0.0483	Causality exists
Group 2			
RD does not Granger Cause TFP1	3.11918*	0.0479	
UNEMPL does not Granger Cause TFP1	3.84985*	0.0234	
TFP1 does not Granger Cause INFL	4.00296*	0.0199	
RD does not Granger Cause ENTER	2.63913*	0.0885	
INFL does not Granger Cause RD	5.60474**	0.0047	
RD does not Granger Cause INFL	3.28660*	0.0408	
INFL does not Granger Cause UNEMPL	2.96728*	0.0544	
UNEMPL does not Granger Cause INFL	3.44949*	0.0342	

Notes: ***,**,*Significant at 1, 5, and 10 percent levels, respectively. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table IV.
Granger Causality Test

Therefore, the causality relation is only unidirectional relation. From results, TFP can influence RD in the short run dynamics and the computed p-value is significant at 1 percent, the causality relation is only unidirectional relation. Moreover, there is a multidirectional relation between unemployment and TFP and between inflation and TFP in the short run (for Group 1). A detail relationship direction for Group 1 is illustrated in Figure 1.

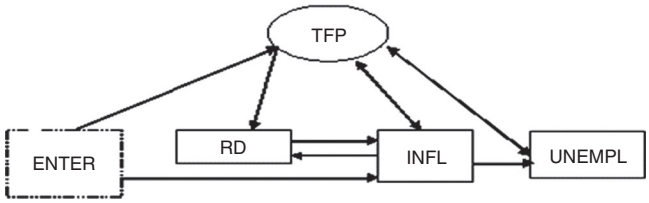
Results for Group 2 showed that R&D and unemployment can influence TFP and inflation in the short run dynamics and the computed p-value is significant at 10 percent. The null hypothesis cannot be rejected (for Group 2). In addition, TFP can influence inflation and RD can influence entrepreneur. Therefore, the causality relation is only unidirectional relation.

From results, inflation can influence RD and inflation can influence unemployment. In the short run dynamics and the computed p-value is significant at 10 percent, the causality relation is only unidirectional relation. Moreover, there is a multidirectional relation between inflation and RD and between inflation and unemployment in the short run (for Group 2). A detailed relationship direction for Group 2 is illustrated in Figure 2.

Using GMM model

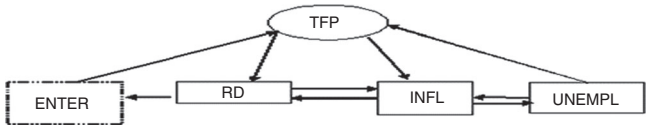
Using GMM with panel data with a relatively short time dimension is a preferred method, with or without the use of the orthogonal deviation method. A panel data regression was run on the TFP model to obtain the estimated coefficients, results reported in Table V.

The estimated coefficients of entrepreneur activities, inflation, unemployment, and R&D have a positive and significant sign for both groups. The stage of growth and the economic setting in each group may be one of the reasons for the significant explanatory variable, as each group reflects a level of development through investing in education and R&D to promote more skilled and specialized labor and capital inputs.



Source: Designed by the author

Figure 1.
Granger Causality Test for very high human development group



Source: Designed by the author

Figure 2.
Granger Causality Test for high human development group

5. Conclusions and policy recommendations

Theories on growth emphasized on innovation and creativity as one of the explanatory variables and as a source of growth. In addition, empirical studies focus on the contribution EAs as mediating channel for growth. In this paper, the contribution to literature is threefold. First, it seeks to examine the effect of EA on TFP. Second, it attempts to test for the moderating effect of human development on the relation between EA and TFP. Third, it tests the causality between TFP, EA, R&D, unemployment, and inflation across countries.

Results confirm the significant effect of EA on TFP in the countries under study but the EA effect is more in the first group as estimates of the coefficient of ENT is (0.0282) reflecting that the relative contribution of EA to TFP is higher in Group 1 than Group 2. In particular, countries with higher level of human development have a significant effect on TFP. This significant effect highlights the important role of EAs; R&D on TFP, as the estimates of the coefficient of R&D (0.054) is higher than the second group. These results support "Coe and Helpman" for the role of R&D in addition to the role of entrepreneur on total productivity. In Group 1 where the majority of the countries are characterized of being high developed countries as they focus on the human development; and the enhancement to the institutional arrangements within the required economic activities. Thus EAs have direct and significant effect on the TFP. In addition, these countries governments support entrepreneurship via achieving stable low inflation rate, altering taxation policies to attract small firms in the economic activities. These main policies provide sound governmental policies which lead to lower unemployment rate, improve confidence in the private sector, consequently attract investments, increase production, and standard of living. The analysis also concludes that inflation rate has a negative significant effect on total productivity in Group 1 and negative in Group 2 and this may refer to the level of development in this group of countries, and this supports literature. As more volatile macroeconomic policies increase uncertainty and risk; thus inflation has a negative effect on TFP.

6. Discussion and finding

EAs has multi impacts as it influences operational function, production, per capita income, employment, standard of living, innovation, and capital accumulation. This paper has tried to confirm the seemingly public debate involving R&D and linking it to the role of EAs on growth. Results confirm the important role that

Variable	Coef. Group 1	Group 2
ENT	0.789948***	0.173693***
	(0.038287)	(0.030420)
R&D	0.491143***	0.475630***
	(0.054829)	(0.0473838)
UNEMP	0.101530***	0.216533***
	(0.021715)	(0.020280)
INF	−0.169692***	−0.091327***
	(0.029113)	(0.025745)

Notes: ***,**,*Significant at 1, 5, and 10 percent levels, respectively. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table V. GMM estimates for very high human development, high human development countries

entrepreneurship plays in the countries which is vital for TFP; the issue that requires suitable public policy planning. Overall, the results showed that policies which promote EAs require investing in R&D, the importance of the human development, fiscal policies are important determinates to entrepreneurs. Based on the finding and research implications, the following policy measures are recommended. R&D are important determinants in promoting the TFP across countries. In this perspective, governments should focus on improving the budget allocation to R&D to strengthen research for technological progress.

Inflation increases the cost for entrepreneur to start a business which increases the risk in countries, inflation has a negative impact on TFP growth and therefore, on the economic growth. This requires adopting macroeconomic policies to control inflation to increase the confidence in the economy and attracts investors. Moreover, EAs relying on innovation require a set of policies to encourage disseminating research carried out in universities and governmental research centers. Financial support programs and grants are needed to support firms to develop new products. Recently, improvement in technology is highly needed especially in the information technology sector. There is a need for integrate policies and decision makers to take a long-term plans to develop policies to enhance and deepen the role of EAs. More skilled workers who are more able to perform better in a dynamic environment, supported with knowledge-based economy, which leads to increase productivity.

Worth mentioning that this paper did not focus on the other side of the picture by including less human development countries but this limitation is refereed to source of the entrepreneurship data. In the future, a similar study can be conducted with increased number of observations and extending the time frame and adding more control variables.

Notes

1. It is a standard means of measuring well-being, especially child welfare. Countries fall into four broad human development categories: Very High Human Development, High Human Development, Medium Human Development and Low Human Development.
2. These opportunities represents: new products, new production methods, new organizational schemes and new product-market combinations and to introduce their ideas in the market, in the face of uncertainty and other obstacles, by making decisions on location, form and the use of resources and institutions.

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Appendix

Essence of definition	Publication
Entrepreneurs buy at certain prices in the present and sell at uncertain prices in the future. The entrepreneur is a bearer of uncertainty	Cantillon (1755/1931)
Entrepreneurs attempt to predict and act upon change within markets. The entrepreneur bears the uncertainty of market dynamics	Knight (1921)
The entrepreneur is the person who maintains immunity from control of rational bureaucratic knowledge	Knight (1942), Weber (1947)
The entrepreneur is the innovator who implements change within markets through carrying out new combinations. These can take several forms: The introduction of a new good or quality thereof The introduction of a new method of production The opening of a new market The conquest of a new source of supply of new materials or parts, and The carrying out of the new organization of any industry	Schumpeter (1934)
The essential act of entrepreneurship is new entry. New entry can be accomplished by entering new or established markets with new or existing goods or services. New entry is the act of launching a new venture, either by a start-up firm, through an existing firm, or via internal corporate venturing	Lumpkin and Dess (1996)
Entrepreneurship is the mindset and process to create and develop economic activity by blending risk-taking, creativity and/or innovation with sound management, within a new or an existing organization	Commission of the European Communities (2003)

Table AI.

Source: Thurik and Wennekers (1999)

Group 1	Group 2
Andorra	Albania
Australia	Argentina
Austria	Belarus
Barbados	Bosnia and Herzegovina
Belgium	Brazil
Brunei Darussalam	Bulgaria
Canada	Chile
Cyprus	Colombia
Czech Republic	Costa Rica
Denmark	Croatia
Finland	Ecuador
France	Estonia
Germany	Hungary
Greece	Kazakhstan
Hong Kong SAR, China	Latvia
Iceland	Lebanon
Ireland	Lithuania
Israel	Macedonia
Italy	Malaysia
Japan	Mauritius
Korea, Rep.	Mexico
Portugal	Panama
Qatar	Peru
Singapore	Poland
Slovenia	Romania
Spain	Russian Federation
Sweden	Saudi Arabia
Switzerland	Serbia
United Arab Emirates	Seychelles
UK	St. Lucia
USA	Turkey

Table AII.
List for the countries under study

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