



Knowledge Spillover Entrepreneurship and Economic Development

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Abstract. This paper seeks to identify whether knowledge spillover entrepreneurship is homogenous across different levels of economic development. Based on a data set measuring entrepreneurial activity at the country level across a broad spectrum of development contexts, the empirical evidence suggests that entrepreneurial activity is related to investments in new knowledge in the context of the most developed countries but not for less developed countries.

Keywords: entrepreneurship, knowledge spillover, growth.

1. Introduction

A major concern in the entrepreneurship literature is the origins of entrepreneurial opportunities and the strategies that can be deployed to take advantage of them. One important source of entrepreneurial opportunities has been identified by a recent literature as knowledge created in one organizational context but commercialized by a new firm (Agarwal, Audretsch and Sarker, 2007). Entrepreneurial activity emerging from the spillover of knowledge created in a different organization has been termed to constitute *knowledge spillover entrepreneurship*. In particular, the extant literature focusing on knowledge spillover entrepreneurship has found that contexts that are rich in knowledge investments have a greater propensity to generate entrepreneurial activity. By contrast, those contexts that with an impoverished knowledge investment generate less entrepreneurship. The context analyzed has ranged from the organizational structure of a firm (Klepper, 2001; Agarwal et al., 2004) to cities and regions (Acs and Szerb, 2009) and to entire countries (Erken, Donselaar and Thurik, 2008; Acs and Szerb, 2009). The resulting empirical evidence linking entrepreneurial activity to investments in new knowledge has been remarkably robust and consistent across this wide range of organizational and spatial contexts. The consistently positive relationship between knowledge and entrepreneurship has been interpreted as a reflection of knowledge spillover entrepreneurship, where the creation of a new venture serves as a conduit for the spillover of knowledge produced but not commercialized in an incumbent firm or organization.

However, while there has been a growing body of literature linking entrepreneurship to knowledge spillovers, virtually all of these studies have been

within the context of the most highly developed countries (Audretsch and Keilbach, 2007). There are reasons to suspect that entrepreneurship emanating from knowledge spillovers may not be homogeneous across all levels of economic development. The biggest reason for this is that investments in knowledge and the role that knowledge plays in generating competitiveness may vary considerably along with the level of economic development. In the context of the most highly developed countries, it is now well known and generally accepted that investments in new knowledge is the driving force of competitiveness and growth (Porter, 1990). However, in the context of less developed countries, other factors access to basic necessities such as food and shelter are more important and supersede the role of knowledge as a source of economic growth (Porter, 1990).

The purpose of this paper is to provide the first examination whether knowledge spillover entrepreneurship plays the same role across different levels of economic development. The main hypothesis suggesting that knowledge spillover entrepreneurship may vary across different levels of economic development is introduced in the second section of this paper. In the third section, a database identifying country-specific levels of entrepreneurship along with other factors compiled by the World Bank is explained. These data are used in the fourth section to test the main hypothesis that knowledge spillover entrepreneurship is more prevalent for countries characterized by higher levels of economic development than for less developed countries. A discussion of the main results and their implications for knowledge spillover entrepreneurship and the development context is provided in the fifth section. Finally, a summary and conclusion are presented in the sixth section. In particular, the empirical results of this paper suggest that knowledge spillover entrepreneurship is more prevalent in the context of the most developed countries than in less developed countries.

2. Knowledge Spillover Entrepreneurship and the Development Context

While a large literature has existed on why entrepreneurship exists and varies across contexts, attention has recently turned to focus on the role of knowledge spillovers as a catalyst for entrepreneurship (Agarwal et al., 2007). Knowledge spillover can have various forms. Griliches (1979) presented two forms of spillovers: one, associated with the exchange of goods (rent spillover), and knowledge arising from the research and development (R&D) process. Knowledge spillover entrepreneurship characterizes the startup of a new firm based on knowledge or ideas generated but not completely or exhaustively commercialized in an incumbent firm. The new firm is started in an effort to bring ideas that are perceived to be of value to the entrepreneur(s) but not necessarily to the incumbent firms or organizations, which created that knowledge (Audretsch and Keilbach, 2007).

The empirical evidence linking entrepreneurship to knowledge spillovers has spanned a broad spectrum of analytical contexts. One strand of literature (Klepper 2001; Agarwal et al., 2007) has focused on the accumulation of capabilities and knowledge within high-performing organizations and firms as an incubator of spin-offs. The greater propensity for high performing incumbent firms to generate high-performing entrepreneurial startups, or what is termed in the literature spin-offs, is interpreted as providing evidence that the high performing incumbent firm provides a better context for the employee-entrepreneur to accumulate knowledge and ideas that ultimately drives the higher observed entrepreneurial performance of the start-up. Similar evidence has been found for startups emanating from knowledge generated at universities (Lowe and Feldman, 2008, Audretsch and Lehmann, 2006).

A different strand of literature has focused on the spatial relationship between investments in knowledge and the geographic dimension of startup activity. In particular, studies have systematically found that, after controlling for other key factors, regions (Acs and Armington, 2006; Audretsch and Keilbach, 2007; and Acs et al., 2009) exhibiting higher investments in new knowledge also generate higher rates of new-firm startups. The positive relationship between knowledge investments and new-firm startups, which has been found to hold for spatial levels of the city, region and country, has been interpreted as supporting the hypothesis that knowledge is commercialized via the startup of new firms. In particular, the relationship between investments in new knowledge and startup activity has proven to be more robust for startup activity in high-technology industries than for general startups.

However, to date, no study has examined the link between entrepreneurship and knowledge spillovers across different contexts of economic development. The empirical evidence to date has been undertaken solely in the context of the most developed countries. This omission or restriction is somewhat striking, because there are compelling reasons to suspect that the role of knowledge spillovers in generating entrepreneurial activity may not be invariant to the level of economic development.

The competitiveness of less developed countries may be shaped by different factors than for the developed countries. In particular, innovation-generating knowledge has emerged as a key factor in the context of the most developed countries (Porter, 1990). By contrast, the more traditional factors of unskilled labor and physical capital bestow competitiveness in developing countries (Porter, 1990). This would suggest that the factor of knowledge, particularly in the way that it has been analyzed in the literature on knowledge spillover entrepreneurship, in terms of investments in research and development (R&D) and human capital may be less important for competitiveness in the less developed countries than it is for the most developed countries. If knowledge is less important as a resource yielding a competitive advantage in the context of less developed countries, then it would not provide any particular competitive

advantage upon which to launch a new venture. Thus, the main hypothesis of this paper is that investments in new knowledge would not be expected to generate or induce entrepreneurship in the context of less developed countries as they do in the most developed countries.

Of course, the knowledge context is not the only spatial factor that studies have found to influence entrepreneurial activity. Regulations (Ho, Wong, 2007), governmental interference and corruption (Djankov, Laporta and Schleifer, 2002), administrative costs (Stel, Storey and Thurik, 2007), taxes (Bohata and Mladek, 1999; Hashi, 2001; Bartlett and Bukvic, 2001), education (Bohata and Mladek, 1999; and Roberts and Tholen, 1998) have all been found to influence the geographic distribution of entrepreneurial activity across countries. In addition, the openness to and involvement in international trade has been found to influence entrepreneurship. For example, Murphy et al. (1991) found that lower communication and transportation costs promote trade that in turn promotes entrepreneurial activity. Similarly, Rauch and Watson (2002) show how the openness to trade can be a source for entrepreneurial opportunities. In testing for the relative importance of knowledge investments for entrepreneurial activity, these other factors must be included as control variables.

3. Measurement and Data

There is a growing literature trying to explain why entrepreneurial activity varies across countries. The data set provided by the Global Entrepreneurship Monitor (GEM) has generated a number of studies linking country-specific characteristics to different measures reflecting entrepreneurial activities across countries. One of the advantages of the GEM data set is that it spans a broad spectrum of stages of economic development. Thus, studies including less developed countries along with the most developed countries, such as van Stel, Storey and Thurik (2007), were able to examine the link between administrative burdens, such as time, cost, or the number of procedures required to start a new business to startup activity. Similarly, Ho and Wong (2007) found that costs associated with regulations prevent entrepreneurs from seeking new ventures. However, none of the GEM studies to date have linked entrepreneurial activity to knowledge investments, at least in the form of R&D.

In this paper we use a database provided by the World Bank Group Survey to identify the startup rate and business density rate for countries spanning a broad spectrum of levels of economic development. The startup rate and business density are used as the dependent variable. The startup rate is defined as the number of firms newly registered divided by the total number of firms registered and business density is defined as the number of registered firms as a percentage of the active population between 15 to 64 years old. In order to assess the time varying effects, we employ pooled time series, cross sectional research design.

To test the main hypothesis of this paper, the startup activity was linked to the investment in new knowledge along with the control variables for countries classified as being less developed and compared with countries classified as being highly developed. The method used to classify countries according to the level of economic development was taken from the World Bank. World Bank classifies countries in four different categories--- Low income, lower middle income, higher middle income, and hi income. Countries classified as being low income had per capita income of \$1,005 or less; lower middle income had a per capita income between \$1,006 and \$3,975. Countries classified as being upper middle had a per capita income between \$3,976 and \$12,275, and high income had a per capita income \$12,276 or more. In this article, we combined low and lower middle income countries since there were few low income countries in our sample. List of countries used in this article is included in the appendix.

The model estimated is:

$$\ln ER = f(CB, T, TC, TX, R, GDP, FDI) \dots (1)$$

$$\ln BD = f(CB, T, TC, TX, R, GDP, FDI) \dots (2)$$

Where ER is the business startup rate, BD is the business density rate, CB is the domestic credit provided by banking sector, T is the total trade, TC is time required enforce contract, TX is taxes on capital gains, GDP is the gdp per capital annual (%) growth, FDI is the foreign direct investment, and R is researchers per million people.

To test the main hypothesis of this paper, a measure of investment in new knowledge is needed as an independent variable. The World Bank data set also includes the number of researchers involved in R&D in each country divided by the population (millions). A positive coefficient on this variable would be consistent with the knowledge spillover theory of entrepreneurship, which posits that entrepreneurial activity will be greater in high-knowledge contexts. As discussed in the previous section, almost every previous study has found a positive coefficient on the variable reflecting knowledge investments, albeit solely in the context of the most developed countries. However, the main hypothesis of this paper suggests that investments in knowledge may influence entrepreneurial activity differently depending upon the economic development context.

As the previous section explained, there are a number of control variables that need to be included in the empirical model to account for other factors that have already been identified to influence variations in entrepreneurship across different country contexts. The openness of the country to international trade is used as a control factor and is measured as the sum of exports plus imports divided by gross domestic product in 2005. The variable is taken from the World

Bank data set. A positive coefficient would suggest that countries involved in more trade also exhibit more entrepreneurial activity.

Previous studies have identified the property rights as an important factor shaping the variation of entrepreneurial activity across countries (Murphy, 1993; and North, 1991). One aspect reflecting variations in the property rights regime is the time required to enforce a contract, which is taken from the World Bank data set. A negative coefficient would suggest that a property rights regime that is more sluggish in processing claims, conflicts, and enforcement of contracts exhibits lower levels of entrepreneurial activity.

A number of studies (Gentry and Hubbard, 2000; Long, 1982; and Blau, 1987) suggest that taxes influence entrepreneurial activity. To reflect the country-specific tax regime, a variable from the World Bank is used that measures the taxes on income, profits and capital gains divided by total taxes. A negative coefficient would imply that entrepreneurial activity is impeded by higher taxes.

The definitions of each variable are given in Table 1. In the cases involving missing values of a variable, values were imputed based on the mean values of the variables for other countries at a similar level of economic development. Table 2 shows the mean and standard deviation for each variable, and Table 3 provides a correlation matrix.

Table 1: Definition of Variables

Variables	Definition	Sources
Research Investment	Researchers in R&D (per million people)	World Development Indicator
Lack of contract enforcement	Time required to enforce a contract (days)	World Development Indicator
Trade	Trade (% of GDP)	World Development Indicator
Foreign Direct Investment	Foreign direct investment, net inflows (% of GDP)	World Development Indicator
Tax on Profit	Taxes on income, profits and capital gains (% of total taxes)	World Development Indicator
Business Density	Business Density is the number of total registered corporations divided by total working age population.	World Bank Group Enterprise Survey
Financing Availability from formal institutions	Domestic credit provided by banking sector (% of GDP)	World Development Indicator
Business Entry Rate	Business entry rate (new registrations as % of total)	World Bank Group Enterprise Survey
Economic Development	GDP per capita (annual % growth)	World Development Indicator

Table 2: Descriptive Statistics

	Mean	Standard Deviation	Minimum	Maximum
Financing Availability from formal institutions	90.88	56.40	-3.45	304.84
Tax on Profit	40.63	17.14	7.21	92.57
Research Investment	2217	1800	14.83	7998
Economic Development	3.30	2.91	-15.13	13.69
Foreign Direct Investment	12.10	50.55	-15.10	524.88
Trade	93.81	66.00	21.74	462.46
Lack of contract enforcement	562.16	312.54	120.00	1510

Table 3: Correlation Matrix

Pearson Correlation Coefficients, N = 376							
Prob > r under H0: Rho=0							
	Financing Availability from formal institutions	Tax on Profit	Research Investment	Economic Development	Foreign Direct Investment	Trade	Lack of contract enforcement
Financing Availability from formal institutions	1.00	0.62	0.50	-0.38	0.08	0.004	-0.24
		<.0001	<.0001	<.0001	0.1057	0.9374	<.0001
Tax on Profit	0.62	1.00	0.35	-0.24	0.05	-0.028	-0.19
	<.0001		<.0001	<.0001	0.3374	0.5912	0.0002
Research Investment	0.50	0.35	1.00000	-0.14	0.20	0.26	-0.50
	<.0001	<.0001		0.0073	0.0001	<.0001	<.0001
Economic Development	-0.36	-0.24	-0.14	1.00000	0.02	0.17	-0.03
	<.0001	<.0001	0.0073		0.7527	0.0010	0.5046
Foreign Direct Investment	0.08	0.05	0.20	0.02	1.00000	0.45	-0.13
	0.1057	0.3374	0.0001	0.7527		<.0001	0.0119
Trade	0.004	-0.028	0.26	0.17	0.45	1.00	-0.26
	0.94	0.59	<.00001	0.0010	<.00001		<.00001
Lack of contract enforcement	-0.24	-0.19	-0.49	-0.03	-0.13	-0.26	1.000
	<.00001	0.0002	<.00001	0.50	0.0119	<.00001	

4. Empirical Results

The empirical results are provided in Table 4 and Table 5. The Table 4 shows results for the entry rate and Table 5 for the business density rate. The first columns of both tables show results for all countries, regardless of the level of economic development. The second column shows the results for the high-income countries, the third column shows the results for the middle-income countries and the fourth column for the low-income countries. List of countries included in this study is included in the appendix.

Table 4: Regression Results for Entry Rate

Variables	Entry Rate_ Aggregate	Entry rate-hi income countries	Entry rate middle income countries	Entry rate low Income countries
Research Investment	0.008 (3.32)**	0.0076 (1.83)***	0.007726 (1.18)	-0.010 (-1.08)
Economic Development	1.52 (1.18)	0.68 (0.22)	0.822289 (0.58)	4.81 (3.18)**
Financing Availability from formal institutions	0.10 (1.18)	0.18 (0.19)	0.039164 (0.32)	-0.43 (-2.03)**
Tax on Profit	0.36 (1.39)	1.24 (3.05)**	-0.94101 (-2.63)**	-0.57 (-1.46)
Foreign Direct Investment	-0.10 (-1.26)	-0.12 (-1.37)	5.78256 (3.84)**	0.016 (0.03)
Trade	0.17 (2.77)**	0.26 (3.08)**	-0.34743 (-1.52)	0.61 (2.51)**
Lack of contract enforcement	-0.006 (-0.17)	-0.05 (-1.29)	-0.06193 (-3.84)	-0.08 (-3.92)**
Intercept	67.50 (4.14)*	0.17 (0.00)	143.5556 (5.82)	118.33 (4.45)*
R-squared	0.12	0.19	0.3788	0.49

*1% significance level, ** 5% significance level, *** 10% significance level

Table 5: Regression Results for Business Density

Variables	Business_ Density_aggregate	Business Density hi_income_countries	Business Density middle_income_countries	Business Density_low_ income_countries
Research	0.50	0.32	-0.57	0.82
Investment	(3.82)**	(1.38)	(-3.85**)	(5.59*)
Economic Development	-0.97 (-3.73)**	-1.25389 (-3.03)**	-3.78 (-3.17**)	0.18 (0.64)
Financing Availability from formal institutions	24.53 (6.03)*	29.81 (4.30)*	-3.53 (-1.30**)	-8.91 (-2.76**)
Tax on Profit	-1.65 (-2.74)**	-2.33901 (-1.85)	-1.46 (-3.43**)	0.69 (2.59**)
Foreign Direct Investment	3.54 (0.89)	3.58 (0.7)	12.32 (0.37)	-3.47 (-0.47)
Trade	-8.86 (-2.66)**	-9.07 (-1.95)***	1.60 (0.3)	9.30 (2.63)**
Lack of contract enforcement	1.07 (1.32)	6.41 (2.23)**	0.12 (0.34)	1.56 (6.96*)
Intercept	734.53 (1.13)	794.49 (0.47)	2209.44 (3.89**)	-867.25 (-2.72***)
R-squared	0.26	0.2558	0.24	0.69

* 1% significance level, ** 5% significance level, ***10% significant

Knowledge investments, as reflected by R&D intensity have a statistically significant and positive impact on entrepreneurial activity for high-income countries but not for low-income countries and for both business entry rate and business density. This would suggest that knowledge spillover entrepreneurship might be more important for the most highly developed countries but not in the context of less developed countries. Economic development has a positive impact on entry rate and the relationship is significant for the lower income countries. However, economic growth has a negative and significant relationship with business density variable since growth of a country has differential impact on different areas.

The positive and statistically significant coefficient for the access to financial availability from the formal institutions, presented in the first column suggests that finance is crucial for entrepreneurial activity and positively related to entrepreneurial activity. However, as the statistically significant coefficient in the fourth column implies that financial resource from formal institutions have negative impact on entrepreneurial activity in the context of low-income countries than in high-income countries. Formal institutions require higher level of collateral than informal sources of funding either in developed or developing

countries. The problem is more severe in developing countries since people have very little tangible assets that can be used as collateral. This requirement of collateral makes it close to impossible for many to obtain appropriate level of financing.

Openness to foreign trade has a differential impact on entry rate and business density but has a similar impact on high and low-income countries. Similarly, the lack of contract enforcement is also found to have a differential impact on both the entry rate and business density but has a similar impact on high and low-income countries. However, foreign direct investments do not have a statistically significant impact on entrepreneurship for either high or low-income countries.

5. Discussion

There are two important findings to emphasize from this study. The first, important insight involves the role of knowledge spillover entrepreneurship. A number of previous studies (Audretsch and Keilbach, 2007; Acs et al, 2009) infer that entrepreneurship serves as a conduit for the spillover of knowledge produced in one organization but commercialized in a new organization from the statistical significance of a variable reflecting investment in new knowledge, such as R&D intensity, on a measure of entrepreneurship. However, these studies have only examined the role of knowledge spillover entrepreneurship within the context of highly developed countries. The results presented in the previous section suggest that, in fact, investments in new knowledge do not generate entrepreneurial activity within the context of less developed countries.

The second is more general, is that, factors influencing or hindering entrepreneurship are not homogeneous across development levels. While most of the previous studies have tried to identify factors promoting or impeding entrepreneurship at the country level, they have not distinguished between the development context. The results presented in the previous section clearly suggest that what actually is conducive to entrepreneurship and what impedes entrepreneurship depends upon the development context. Factors such as lack of financial resources and enforcement of contracts are found to impede entrepreneurship more in the context of developed than in less developed countries.

So why is knowledge spillover entrepreneurship not an important factor within the developing country context? One possible explanation is consistent with Porter's (1990) re-interpretation of Rostow's (1971) notion that less developed countries tend to rely on natural resources as a driver of international competitiveness. On the other hand, most developed countries rely on innovative activity as the source of international competitiveness. The competitive advantage of less developed countries is generally less oriented towards innovative activity and more toward exploitation of natural resources. As Acs and

Szerb (2009, p. 11) point out, the innovation-driven stage is marked by an increase in knowledge-intensive activities (Romer, 1990). In the efficiency-driven economy capital and labor play a crucial role in productivity. Therefore appropriate level of labor supply has an impact on the firms' decision-making process. In the innovation-driven stage knowledge provides the key input. In this stage the focus shifts from firms to agents in possession of new knowledge (Acs, Szerb, 2009). The agent decides to start a new firm based on expected net returns from a new product. The innovation-driven stage is biased towards high value added industries in which entrepreneurial activity is important (Jorgenson, 2001). Aquilina, Klump and Pietrobelli (2004) suggest that the easier it is to substitute capital for labor, the easier it is to become an entrepreneur. According to Porter (1990), the innovation driven stage requires more innovative activity due to higher demand for sophisticated consumer products. Because of a higher consumer demand for sophisticated products, industries require an increased level of innovation to remain competitive. At the Innovation driven stage, innovation becomes the tool for attaining competitive advantage rather than the primary/raw products. Therefore there is increased pressure for industries in the innovation stage toward innovative activity.

Thus, not only are institutional factors found to have a differential impact on entrepreneurship between highly developed and less developed countries, but also the empirical evidence suggests that the impact and role of knowledge spillover entrepreneurship also depends upon the economic development context. The results found in this study would indicate that while knowledge spillover entrepreneurship generated by investments in new knowledge is an important source of entrepreneurial activity in the context of highly developed countries, it is not important in the context of developing countries.

6. Conclusion

A recent wave of studies has emerged identifying the important role that entrepreneurship, and new firms in particular play in the process of innovation and growth. Knowledge spillover entrepreneurship refers to the start up of a new firm as a response to an opportunity to commercialize knowledge created in the context of an incumbent organization but not fully exhausted or used by that incumbent. Knowledge spillover entrepreneurship is important not only because it explains why certain people become entrepreneurs, but also why that entrepreneurship provides an important conduit for the spillover of knowledge, which ultimately generates innovation and economic growth.

However, the links between knowledge investment and entrepreneurship have been examined only within the context of the most developed countries. Whether knowledge investments spur subsequent entrepreneurial activity within the context of less developed countries has remained a conjecture at best. This

paper has explicitly examined whether the links between investments in new knowledge and entrepreneurial activity are invariant to the levels of economic development. The empirical results suggest that, not only does entrepreneurship respond to different institutional impediments differently depending upon the development context, but also in particular, the response to knowledge investments systematically differs across different economic development contexts. This study finds that investments in new knowledge generate entrepreneurial activity in the context of the most developed countries but not for less developed countries.

Thus, while knowledge spillover entrepreneurship may explain the recent surge in interest in entrepreneurial activity in highly developed countries; this should not be automatically imposed on countries that are less developed. While entrepreneurship may have an important role to play in the context of less developed countries, this paper finds that providing a conduit for knowledge spillovers is not an important factor.

Future research needs to probe further how the development context influences the role played by entrepreneurship, both why people choose to become entrepreneurs as well as its impact. As the results of this paper make clear, a policy approach to economic development and growth that ignores the crucial distinction in the role-played by entrepreneurship across development contexts would be both naïve and misguided.

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- World Development Indicator.
- World Bank Group Enterprise Survey.

Appendix

Appendix 1: List of Countries

Low and Lower Middle Income	Upper Middle Income	Hi Income
Bolivia	Algeria	Australia
India	Argentina	Austria
Indonesia	Bulgaria	Belgium
Madagascar	Chile	Canada
Bolivia	Colombia	Croatia
	Costa Rica	Cyprus
	Kazakhstan	Czech Republic
	Lithuania	Denmark
	Mexico	Finland
	Romania	France
	Russian Federation	Germany
	South Africa	Greece
	Thailand	Hungary
	Tunisia	Iceland
	Turkey	Ireland
		Italy
		Luxembourg
		Netherlands
		New Zealand
		Norway
		Poland
		Portugal
		Singapore
		Slovak Republic
		Slovenia
		Spain
		Switzerland
		United Kingdom
		United States

