JEKEM
An ICA Institute Publication

INDIA, CHINA AND AMERICA INSTITUTE
1549 CLAIRMONT ROAD, SUITE 202 ● DECATUR, GA 30033 USA
WWW.ICAINSTITUTE.ORG

Globalization and International R&D Flows into Emerging Markets: Nomothetic Evidence

Abdullah M. Khan, Ashok K. Roy & Rajaram Veliyath

Journal of Emerging Knowledge on Emerging Markets
Volume 3
November 2011

Globalization and International R&D Flows into Emerging Markets: Nomothetic Evidence

Abdullah M. Khan,
Ashok K. Roy &
Rajaram Veliyath
Kennesaw State University

Journal of Emerging Knowledge on Emerging Markets
Volume 3
November 2011

Investments in research and development (R&D) activities are seen as essential precursors for the creation, dissemination, and absorption of knowledge that is critical for innovation. Endogenous economic growth theories (viz., refer Mankiw, Romer and Weil, 1992; Romer, 1994) also posit investments in R&D as major drivers of economic progress. Economic progress is predicated on output growth which requires product and process innovations that accrue from R&D activities. Several empirical papers such as Lee and Kim (2006), Savvides and Zachariadis (2003) and Guellec and Van Pottelsberghe de la Potterie (2001) have found a positive contribution of R&D activities in enhancing total factor productivity.[1] Investments in R&D activities involve considerable commitments of

[1] Isaksson, (2007) provides an in depth literature review of role of R&D in raising total factor productivity.

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042

financial and skilled human resources that developing or emerging market countries have scarce endowments of. Empirical evidence of the economic benefits of R&D activities has motivated researchers to explore the potential determinants of R&D activities using firm level, industry level, national level and international level data.

However, much of this research has been centered on developed or industrialized countries. The primary reason behind the neglect of developing countries in this body of research has ostensibly been due to data unavailability. Besides, the fact that developed countries undertake more R&D projects, both in terms of volume and sophistication, compared to developing countries or emerging market countries has also been an influential factor.[2]

With the availability of additional data and the increasing importance of emerging market countries in the global economy, researchers are showing renewed interest in comparative studies regarding the effectiveness of various determinants of R&D investments, in industrialized countries as well as among emerging market countries. This paper examines the trends and intensity of transnational R&D flows covering thirteen years from 1990 to 2002. We use a panel dataset of twenty six countries representing both developed and developing countries.

There is a shortage of literature in this genre, particularly in examining the determinants of foreign R&D investment intensity into emerging market countries. We use R&D expenditures of Transnational Corporation (TNC) foreign affiliates as a measure of international R&D flows. Our contributions are as follows. First, we empirically test the effectiveness of institutional environments, patent protection, trade barriers, the extent of human capital, diversity in the country's population and the country's technological environment, as determinants of international R&D investment flows. Second, using a structural break approach we empirically examine whether globalization via the forces of technological diffusion and trade liberalization has significantly affected foreign R&D investment flows. In this process, we separately analyze the impacts of two main individual drivers of globalization, i.e., advances in Information and Communication Technologies (i.e., ICTs) and reductions in trade barriers as determinants of R&D internationalization. Third, we examine if globalization via its dual forces has impacted the flows of transnational R&D investments into emerging market countries. Fourth as a seminal contribution of this paper, we examine the role of ethnic diversity in a country's population in attracting international R&D flows.

The remaining sections of the paper are organized as follows: in section II we discuss the theoretical background; in section III we deal with the methods; in section IV we discuss

[2] According to the OECD science, technology, and patent database, 64 percent of global patents granted in 2008 were awarded to inventors from five OECD countries: Australia, Germany, Japan, USA and UK. Moreover, scientists from the EU, USA and Japan authored about 80 percent of all scientific papers published in that year.

the results; and in section V we provide the conclusions of the study along with some discussion.

THEORETICAL BACKGROUND

Several recent studies have proposed that the pace of globalization has accelerated due to technological advancements and trade liberalization, thus decreasing the costs of haulage, communications, and transactions (e.g., Hummels, 2007; Reddy, 1997a; Reddy and Sigurdson, 1997b ; Storper, 2000). Other studies have focused more on examining the relative contributions of individual drivers of globalization. For example, Garcia-Vega and Huergo (2011) explored data regarding determinants of R&D outsourcing and found evidence that trade was the dominating factor behind the recent globalization of R&D activities. Using data from foreign affiliated R&D laboratories, Florida (1997) found that globalization of innovation was driven mainly by technological factors. Fujita and Thisse (2006) developed a theoretical model that could be used to explain the underlying economic rationale behind the flows of R&D and other productive activities from industrialized western countries to emerging economies. The crux of their arguments was that the costs of transportation and communications fell due to globalization, a process fostered by trade liberalization and technological advancements. This process allowed MNCs to better manage their operations from long distances. This new economic reality has made periphery locations (emerging market countries) more cost-effective compared to central locations (corporate headquarters in industrialized countries). In response to this changed global economic landscape Multinational Corporations (MNCs) began to outsource various activities including R&D activities to cost effective peripheral countries.

Other available evidence (Ernst, 2005; Reddy, 2005; UNCTAD, 2005a/2005b) points to the recent trend in the internationalization of R&D as arising from factors such as increased global competition, global consumer demand for standardized products, increasing demand for knowledge-based technologies and strategic international cooperation of businesses, much of which has been fueled by trade liberalization and advancements in Information and Communication Technologies (ICTs). The benefits from the globalization of R&D for host countries include improvements in productivity, enhancement of export potentials and increases in local science and technology capabilities and resources (Pearce, 1999; Reddy, 2005). Thus, globalization of R&D has often been proposed as a major conduit for technology transfer from developed countries to developing countries and/or emerging market countries, and also as a major source of growth in factor productivity. Guellec and van Pottelsberghe (2001) analyzed data from sixteen OECD countries from 1980 through 1998 and found that an increase of 1 percent in business R&D contributed to an increase of 0.13 percent in productivity growth. This impact was greater in countries where business funded R&D was a greater share of total R&D expenses and where defense-related government funding was relatively lower compared to total public outlay. Another interesting result in their study was that a one percent increase in foreign R&D expenditure contributes to an estimated 0.44 percent increase in productivity growth. This effect was greater for countries which were more intensive in business R&D expenditures.

DOI: 10.7885/1946-651X.1042

Emerging Market Countries (EM)

Emerging markets are those developing country nations whose income levels, GDP per capita, human development indices, market institutions, technological sophistication and production efficiencies have not reached developed country standards. International organizations such as the United Nations and the World Bank have employed numerous indicators to categorize nations into developed and developing country status. However, unlike other developing countries, emerging market nations also have sizeable domestic demand bases, rapid rates of economic growth and development, institutions capable of supporting expanding market-oriented economies, large human capital bases, and the ability to absorb and assimilate technology. Emerging Markets (EM) is a term that was coined by the World Bank in the 1980s. However, in definitional terms, the label has been employed very fluidly. For indexed investment purposes, Morgan Stanley has included 28 countries in this category.

Given the increasing importance of emerging market countries as potential growth markets for MNCs, we posit that there would be greater flows of international R&D into emerging market nations over the examined time period.

Institutional environments

Institutions establish the ‘rules of the game’ through defining the political, social and legal rules governing exchanges and economic transactions between entities (Meyer & Rowan, 1977; North, 1990; Scott, 2001). Accessible, reliable and stable economic, legal and political institutions are necessary in order to attract the inflows of R&D spending into countries (Lundvall, Johnson, Andersen, and Dalum, 2002; Nelson, 2008). These institutions and the political environments they are embedded in are critical determinants of the type of investments that MNCs will make (Doh, Jones, Mudambi, & Teegen, 2005; Murtha & Lenway, 1994). Governmental institutions that reduce political risk and enhance stability influence MNC decisions on whether to off-shore R&D as well as where to invest (Grosse & Trevino, 2005).

Political stability has been defined as the decreased likelihood of violent threats to or changes in government (Kaufman, Kraay, & Mastuzzi, 2005; Pajunen, 2008). Foreign investors are particularly interested in doing business in countries that are democratic and whose citizens have political freedoms. Governments in countries that are politically stable are less likely to be capricious in their behavior towards foreign investors and have established rules of law that provide protection to them. Several previous studies have reported a positive relationship between political stability and FDI inflows (Globerman & Shapiro, 2003; Loree & Guisinger, 1995).

Outcomes from R&D are in the form of intellectual properties such as patents, proprietary designs and processes. Internationalization of R&D can only take place under conditions where countries respect, guarantee and enforce intellectual property regimes. However, rules governing the different forms of intellectual property (IP) vary across countries in terms of the exclusivity guaranteed to the inventor, the respect for foreign IP, and the consequences of unauthorized usage. The comprehensive system of coverage, duration of protection, a country's membership in the different IP conventions and treaties, the measures against loss of protection, and the enforcement mechanisms available all contribute towards establishing a comprehensive rating of a country's commitment to the protection of intellectual property (Ginarte & Park, 1997; Grupp & Schmoch, 1999; Ostergard, 2000). We consider all these aspects of intellectual property rights are vital for construction of Patent Rights Index, a specific measurable indicator for each country. Increased Patent Rights would increase technological dynamism and reduce the perceived risk of off-shoring R&D into that country. Countries with adequate Patent Rights enhance the appropriability of the R&D investments made by companies into that country (Allred & Park, 2007; Cohen & Levinthal, 1990; Feinberg & Gupta, 2004; Kumar, 1996). Analyzing patent citation data, Bascavusoglu (2005) reported that international trade facilitates technology transfer in emerging market countries. MacGarvie (2004) used patent citations to measure international diffusion of technological knowledge and found that trade fostered such diffusion only when countries' inventions are similarly distributed across fields.

We anticipate the greater political stability and increased patent protection would facilitate greater international R&D inflows.

Trade Barriers

There are a number of studies which support the view that decreased tariff barriers enhance international trade and intensify global competition, thus pushing firms to be more R&D intensive in order to retain or expand their market share by offering innovative products of higher quality (Long, Raff, and Stahler, 2011; Lumenga-Neso, Olarreaga, and Schiff, 2005). Other empirical papers have showed a positive relationship between increased import competition due to a reduction in trade barriers and increased investments in R&D in high tech industries (e.g., Zietz and Fayissa, 1992). Alternatively, tariff rate increases can also lead to increased R&D activity in the home country (at least in the short run); especially if the home market size is large and if monopolistic firms are fighting for retention or expansion of market shares. For example, Krugman (1984) explained that trade barriers whether in the form of quotas or tariffs, could influence firms to increase investments in R&D. Reitzes (1991) showed that tariffs may lead to increased investments in cost-reducing R&D, while alternatively quotas would reduce R&D. Liebman and Reynolds (2010) found that firms increased R&D investments when 'safeguard' protective tariff rates were imposed.

There are yet other papers which model R&D activities and foreign direct investment (FDI) activities as either substitutes or complements, and empirically explore the magnitude of such complementarities or substitutions under liberalized or protective trade regimes (e.g., Roy and Acharyya, 2009). Grossman and Helpman, (1991) contend that trade liberalization pushes firms to either increase or decrease their R&D investments. Thus, on the one hand trade liberalization promotes competition among firms in different countries and thus provides incentives for technological innovation via strengthening R&D activities. On the

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042

other hand increased global competition fostered by decreased tariff barriers results in a lower profitability of firms' R&D investments thus discouraging their incentives to invest. Overall, there is a wealth of literature regarding the role of trade liberalization, especially tariff rate reduction, on technology transfer, R&D activities, and local and international R&D collaboration. Baldwin and Gu (2004) analyzed the relationships between Canadian manufacturing export performance and productivity growth and innovation. They reported that as trade barriers fell, Canadian firms' share of the global export market increased and exporting firms became more innovative.

We expect that increased trade barriers would hinder international R&D investments. This suggests a negative relationship.

Human Capital

The availability of human capital in a country has been argued to contribute to innovation through shortening technology development cycles and hastening speed-to-market (Archibugi & Coco, 2004/2005; Jones & Teegen, 2003; Lall, 2001; UNCTAD, 2005b). This can enhance the international R&D investments made by MNCs into such country locations. Human capital can be conceptualized as the extent of trained and skilled manpower resources present in the country. Wang (2010) examined data for twenty six OECD countries over eleven years and reported that tertiary education and proportion of scientific researchers were the most positive determinants of R&D intensity. Jaumotte and Pain (2005) analyzed panel data for twenty OECD[3] countries over two decades from 1980 to 2001. They found that main determinants of innovativeness were the availability of scientists and engineers, in addition to other factors like publicly funded research, business-academia partnerships and the degree of product market competitiveness. An aggregate measure would be the number of workers with tertiary degrees. We posit that greater availability of human capital would be associated with greater international R&D inflows.

Technological Environments

Advances in Information and Communication Technologies (ICTs) are characteristic of the sophistication of the country's technology environment. Cerquera and Klein (2008) found that more intensive use of ICT would lead to a reduction in R&D efforts. Polder, Leeuwen, Mohnen and Raymond (2009) reported a complementary effect of ICTs on R&D, although the positive effects were very small in magnitude. Spiezia (2011) found empirical evidence that ICTs enabled firms to innovate, but did not necessarily increase 'inventive' capabilities of incumbent firms. However, the author could not find any evidence that would suggest that use of ICTs enhanced firms' capabilities to collaborate with other firms.

Internationalization of R&D activities into countries is also driven by the need to access location-specific resources such as the technology environment and infrastructure support

[3] OECD (i.e., the Organization of Economic Co-operation and Development OECD) currently has 34 member countries representing Europe, North America, South America and Asia-Pacific.

(Archibugi & Coco, 2004/2005; Jones & Teegen, 2003). Kumar (2001) analyzed the determinants of locations of overseas R&D activities of U.S. and Japanese firms. He reported evidence of at least three factors that favored such location decisions, one among which was the scale of national technological efforts.

After reviewing these inconclusive empirical results from previous work, we posit that the impact of the ICT proxy variable on international R&D flows will be negative. The reasoning is that the use of ICTs would make the production and communication of knowledge and information flows cheaper and faster. Thus foreign affiliates would be able to collaborate on transnational R&D projects from a distance without spending much on brick and mortar R&D facilities in other countries. However, we also expect that with increases in the use of the internet, FDI will increase. As more R&D projects are undertaken, there will be a greater need to commercialize these innovations by launching new products through FDI at cost effective (once considered as peripheral) locations.

Diversity

Foreign R&D investment flows may be correlated with diversity in that more ethnically diverse countries may be more open to undertake internationally collaborative R&D projects. Hunt and Gauthier-Loiselle (2010) found a significant positive relation between increases in immigration and increases in a country's innovativeness. The authors showed that a one percent increase among the immigrant college graduates in the population increased the number of patents per capita by six percent. Niebuhr (2010) reported that cultural diversity of workers enhanced regional R&D performance. Grossman and Maggi (2000) developed a competitive model of trade between two countries, and showed that the countries with greater diversity had comparative advantages over the relatively homogenous countries.

We posit that greater ethnic diversity will be associated with greater international R&D inflows.

Control Variables

We used two control variables in the study. The first was the country's GDP growth rate. Foreign Direct Investment inflows are greater into countries with a higher GDP growth rate. The second control variable was globalization represented by two separate measures.

Kafouros (2006) developed a theoretical model explaining how information and communication technologies (ICTs), specially the internet and other web-based communication devices improved three critical aspects of R&D ('cost', 'time' and 'quality'). Narula (2004) explained how globalization fostered technological diffusion and global convergence of standards. Globalization fostered by technological advances and trade liberalization has progressively made R&D collaboration cheaper, faster and more global over time. For example, in 1995, the internet was officially opened for commercial usage following the decommissioning of the National Science Foundation–managed

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042

NSFNet in April, 1995.[4] In addition, trade agreements reduced tariff and non-tariff barriers to international trade. After the successful conclusion of the Uruguay Round negotiations from 1986 to 1994, the World Trade Organization officially emerged on 1st January 1995. This ushered in a new era of trade liberalization via reduction of various tariff and non-tariff barriers across nations.[5] The convergence of these two major economic events, the emergence of the internet and other web-based ICTs, and a new wave of trade liberalization (spearheaded by the emergence of the WTO) both occurred in the year 1995. Therefore this time frame (1995) provided us with a natural opportunity to investigate and identify the effects of globalization on the determinants of R&D, in the pre and post 1995 years.

Dependent Variable

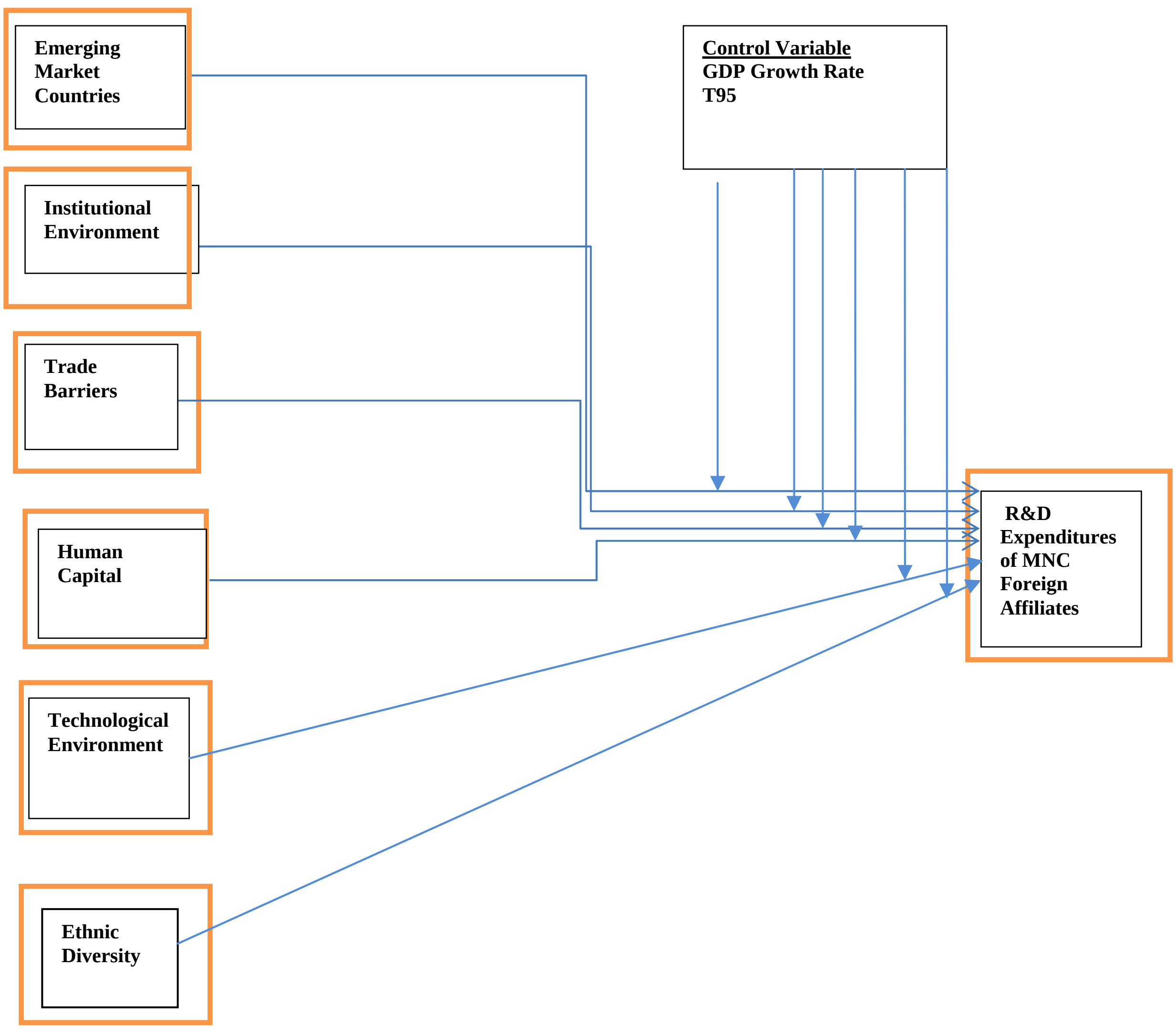
Recent papers (e.g., Gallie and Roux, 2008/2010; Veliyath and Sambharya, 2011;Wang, 2010) are notable for their innovative measures of R&D intensity. Veliyath and Sambharya (2011) used R&D expenditures (in million PPP dollars) of foreign affiliates of MNCs as proxies for international R&D investment flows. Gallie and Roux (2008 and 2010) used 'French Survey of inter-business relationship' (known as ERIE survey) data to analyze the strategic motives of R&D collaborations. Alternatively, Wang (2010) used a measure of R&D expenditures to GDP. None of these earlier studies used R&D expenditures by MNC foreign affiliates as a percentage of the enterprises' total R&D expenditure as a proxy for international R&D investment flows. Therefore, our measure of international R&D flows, foreign affiliates' R&D expenditures as a percent of the MNCs' total R&D expenditures, complements and builds on the measures employed in these above referenced papers. Moreover, none of these papers examined the impact of globalization on transnational R&D flows using a structural break approach.

Our conceptual model is as shown in Figure 1.

[4] www.merit.edu/about/history/pdf/NSFNET_final.pdf

[5] Visit World Trade Organization's official website (http://www.wto.org/english/thewto_e/thewto_e.htm) for more information. Also, see Liu (2009) for new empirical evidence of effectiveness of GATT/WTO in promoting world trade at both intensive and extensive margins.

FIGURE 1
CONCEPTUAL MODEL[a]



[a] **Model Formulation:**

Institutional Environment= (Political Stability, Patent Rights)
Trade Barriers= (Weighted Average Tariffs)
Human Capital= (Workers with tertiary degrees)
Technological Environment= (Share of population with internet access)
Ethnic Diversity = (Inverse ratio of percent share of largest ethnic group to percent share of all other groups in a country)
Control Variables= (Per capita GDP growth rate, T95)

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042

In the following Methods section we discuss the measures, data sources and analysis.

METHODS

Sample

Our sample comprised 26 countries, ranging over a continuum of economic development, from the most developed to the least developed countries. Among these, twelve (12) were developed countries, two (2) were newly industrialized countries, seven (7) were more advanced developing countries, and four (4) were among the least developed countries.

In the developing country group, we primarily selected fast growing and technologically sophisticated emerging market nations while also ensuring broad geographic coverage and trading block representation. Our initial sample pool of emerging market countries included Argentina, China, the Czech Republic, Hungary, India, Israel, Mexico, Poland, Romania, Russia, Singapore, South Africa, South Korea, Taiwan and Turkey. These country classifications were in conformance with those found in other classification schemes adopted in prior research (Furman & Hayes, 2004; Hu & Mathews, 2005; Mahmood & Singh, 2003). Also, according to the World Bank's classification of countries by per capita Gross National Income (GNI) levels, several countries from our primary pool of emerging market countries belonged to the 'high income' country group[6]. These high income countries were the Czeck Republic, Hungary, Israel, South Korea, Poland, Singapore, and Taiwan. Thus, ultimately the final pool of our emerging market countries consists of following eight countries: Argentina, China, India, Mexico, Romania, Russia, South Africa and Turkey[7].

Time Frame

The time frame for the study was the thirteen years from 1990 to 2002, during which time period there was an enhanced impetus towards globalization, cross-border investments and off-shoring of R&D. There was a noticeable shift in R&D FDI towards non-traditional locations like Japan, countries in East Asia, Singapore, India and Israel during the period beginning the 1990s onwards (Dalton & Serapio, 1999; Doh, Jones, Mudambi and Teegen, 2005; Kumar, 2002; UNCTAD, 2005a/2005b).

[6] Using the World Bank's income based classification the following countries in our dataset belonged to the 'high income' country category: (alphabetically): Canada, Czeck Republic, Finland, France, Germany, Hungary, Israel, Italy, Japan, Netherlands, Poland, Singapore, South Korea, Sweden, Switzerland, Taiwan, United Kingdom, and United States.

[7] We have considered a country to be emerging if its per capita gross national income currently belongs to either low income or lower-middle income or upper middle income group, and provided it does not belong to any high income country group. More about the World Bank's country classification criteria can be found at http://data.worldbank.org/about/country-classifications/country-and-lending-groups.

Variables

As discussed, our independent variable was the R&D expenditures of foreign affiliates as a percentage of total enterprise R&D expenditures. The Patent Rights Index (PRI) variable is based on the variable (IPR) used in Veliyath and Sambharya (2011). This variable was obtained for each country using data from various issues of 'Economic Freedom of the World'.[8] The variable *Ethnic Diversity* was calculated as an inverse ratio of the percent of the largest ethnic group to the percent of the rest of the ethnic population in the country,

i.e., $$Ethnic\ Diversity = \frac{Percent\ Sum\ of\ All\ Other\ Minorities\ in\ the\ Country\ Population}{Percent\ of\ Largest\ Ethnic\ Groups\ in\ the\ Country\ Population}$$.

Per construction of the variable, a country's diversity index would rise as population's share of its minority ethnic groups rose relative to population share of its majority ethnic group.

For example, if the largest ethnic groups in country A and country B were 60% and 75% respectively, then their diversity indices would be 0.67 and 0.33 respectively.[9] In that case country A will be more ethnically diverse than country B. The reasoning is that as the share of the majority ethnic group relative to the minority ethnic group(s) in country increases, the propensity for political representation and discretionary governance by the majority ethnic group would also rise, which would contribute to making the country ethnically less diverse. On the other hand, as the share of minority ethnic groups in a country's population increases relative to that of the majority ethnic group, the negotiation power of the minority ethnic groups rises. The presence of a relatively larger minority ethnic group(s) in a country would impose greater pressure on the majority ethnic group to adopt less discretionary and more consultative approaches to governance which will foster ethnic diversity in that country. The data used in the construction of this variable was collected from CIA World Factbook and from some online database.[10] We expect this variable to have a positive impact on international R&D investment flows.

---

[8] Detail description of construction of 'IPR' variable can be seen in Veliyath and Sambharya (2011).

[9] Assume population share of the largest ethnic groups in country A is 60 percent. Then the share of all minority groups in country A will be 0.40 (i.e., 1.0-0.60=0.40). Therefore, inverse ratio of the largest ethnic group to all minority groups in country A will be 0.40/0.60 = 0.67. Similarly, if population share of the largest ethnic group in country B is 0.75, then share of all the minority ethnic groups relative to total population of the country will be 0.25 (i.e., 1.0 - 0.75=0.25). Therefore, for country B, the diversity index will be 0.25/0.75 = 0.33.

[10] We have calculated the variable 'Ethnic Diversity' using ethnic composition data collected from CIA World Factbook and from www.populstat.info.

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9

DOI: 10.7885/1946-651X.1042

Data for construction of the variable 'Political Stability' was obtained from the World Bank's World Governance Indicators database. Most of our other variables were obtained from OECD's Main Science and Technology Indicators (MSTI) database.

The dummy variable T95 measured the impact of globalization and was constructed as follows: for years 1995 and beyond, T95 equaled 1 while for years before 1995 in the study (i.e., 1990 to 1994), T95 equaled zero (0). We expect that the globalization variable would be a positive influence on international R&D investments.

We employed two proxy variables to isolate the impact of the dual forces of globalization-ICTs and liberal international trade. We used the trade weighted average tariff rate as a proxy for measuring trade liberalization. We obtained this variable from the UNCTAD TRAINS database. We contend that increased trade barriers will negatively affect international R&D investment flows. The expectation is that trade barriers would potentially increase the costs of overseas R&D investments. In addition they could diminish the potential returns from those investments. In combination these in turn will discourage foreign affiliates from investing in transnational R&D projects.

The variable internet user per 1000 population was obtained from the World Bank's WDI online database. This variable served as a proxy for advancements in information and communication technologies (ICTs). Very few papers have investigated the impact of ICTs on R&D and assessed the extent to which they are complements or substitutes. Even fewer have studied the impact of ICTs on foreign R&D investments. The little work that exists in the area has created more ambiguity than clarity. However, for reasons mentioned in section II, we expect the impact of the ICT proxy variable on international R&D flows will be negative.[11]

We used the variable 'workers with tertiary education' as a proxy for human capital. We expect this variable to have positive impact on foreign R&D investments. We composed a dummy variable 'emerging' using the per capita national income data as compiled and categorized by the World Bank. Thus the dummy variable 'emerging' took on a value of one (1) when the target country belonged to either the low income group, the lower middle income group, or the upper middle income group and a value of zero (0) otherwise. It turned out that all but three of the high income countries or territories in our dataset belong to OECD countries (three exceptions in our dataset were Singapore, South Korea and Taiwan).[12] Thus our binary variable 'emerging' is expected to convey important information regarding differences in the magnitude and direction of estimated coefficients of independent variables for emerging countries relative to OECD countries. We expected

[11] We have discussed some previous scholarly work on the issue and have explained the reasoning behind our contention regarding the influence of this variable on transnational R&D collaboration in section 2, under the subsection 'technological environment'.

[12] On the other hand, in our pool of emerging countries, Turkey was the only country that was a member of OECD.

this variable to display heterogeneous results because, with regard to some productive factors, OECD countries may have advantages over emerging countries, and in some other instances the reverse may be true.

We also use per capita GDP growth rate as a control variable. Now, we turn to the results of the baseline determinant regression model and some variant specifications in the next section.

Analysis

We tested the model of the determinants of international R&D investments and estimated the magnitude and direction of any changes in the effectiveness of these determinants stemming from globalization. The baseline model was shown in Figure 1 earlier. We employed the generalized least square regression model that controlled for multicollinearity and heteroskedasticity. Our regression models also included some variant interaction specifications to capture the impact of globalization for the periods before and after 1995. The baseline empirical model was as follows:

$$(\textit{Foreign collaboration intensity of R\&D Investments})_{ct} = B_0 + B_1(\textit{Political Stability})_{ct} + B_2(\textit{Patent Rights Index})_{ct} + B_3(\textit{Diversity})_{ct} + B_4(\textit{Trade weighted average tariff rate})_{ct} + B_5(\textit{Internet users as share of population})_{ct} + B_6(\textit{Patent Rights Index})_{ct} + B_7(\textit{Workers with tertiary education})_{ct} + B_8(\textit{GDP growth rate}) + + B_9(\textit{Stochastic error terms})_{ct}$$

In the above model, subscript‘t’ stood for years where t = years 1990, 1991, 2002 and ‘c’ stood for countries, where c = country 1, country 2, country 3, ….., and country 26.[13]

After obtaining regression results for the baseline (determinant) model, we ran regressions for three variant specifications (interaction variants), where we interacted the independent variables with proxy variables for globalization (represented by both ICTs and trade liberalization) and a constructed dummy variable, and also with a dummy variable for emerging market countries. The purpose of using these variant specifications is for a robustness check of the variables posited as some major determinants of transnational R&D investments.

RESULTS

Table 1a reports the descriptive statistics for the variables used in this paper. To maintain comparability and interpretation convenience of the estimated coefficients and standard errors, we transformed all the variables into their natural log values. Table 1b presents the table of intercorrelations among the study’s major constructs.

[13]Data from total 26 countries was used in this study.

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042

TABLE 1A- DESCRIPTIVE STATISTICS

Variable	No. of observations	Mean	Standard. Deviation	Min	Max
Foreign affiliate's R&D expenditure as percent of enterprise R&D expenditure	182	2.829	0.798	-0.105	4.363
Political Stability	338	0.429	0.827	-1.510	1.600
Property Rights Index	325	1.211	0.272	0.392	1.609
Ethnic Diversity	338	0.289	0.488	0.001	2.571
Weighted average tariff rate	201	1.931	0.505	1.048	4.010
Internet users as share of population	315	2.803	2.464	-6.377	6.353
Workers with tertiary level education	353	3.021	0.413	-0.916	3.989

TABLE 1B-CORRELATIONS

		1	2	3	4	5	6
1	Foreign affiliate's R&D expenditure as percent of enterprise R&D expenditure						
2	Political Stability	0.047					
3	Patent Rights Index	0.081	0.535***				
4	Ethnic Diversity	0.243***	-0.001	-0.065			
5	Weighted average tariff rate	0.278***	-0.334***	-0.419***	-0.021		
6	Internet users as share of population	0.108*	0.368***	0.337***	0.164**	-0.537***	
7	Workers with tertiary level education	-0.035	0.028	0.047	0.362***	-0.058	0.077

Note: Correlation coefficients significance is shown at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels.
The subsequent regression results confirmed that multicollinearity was not a problem.

The subsequent regressions controlled for multicollinearity and heteroskedasticity. Our baseline model regression results are presented in column 1 of Table 2. We report the standard errors in parentheses underneath each estimated coefficient values.

TABLE 2- Determinant and Interaction Regression Results

Dependent variable: foreign affiliate's R&D expenditure as percent of enterprise's total R&D expenditure

	Determinant Model Variants		Interaction Model Variants	
	1	2	3	4
Political Stability	0.164***	0.189***	0.244*	0.225*
	(0.040)	(0.042)	(0.134)	(0.134)
Political Stability × T95			-0.262*	-0.175
			(0.143)	(0.146)
Political Stability × T95×Emerging			0.001	0.001
			(0.001)	(0.001)
Patent Rights Index (PRI)	0.986***	0.997***	0.780	0.807*
	(0.061)	(0.062)	(0.474)	(0.462)
PRI × T95			0.146	0.161
			(0.478)	(0.465)
PRI × T95×Emerging			-3.441	-3.360
			(2.427)	(2.383)
Ethnic Diversity	0.251***	0.253***	0.247***	0.251***
	(0.012)	(0.012)	(0.042)	(0.040)
Diversity× T95			0.002	-0.004
			(0.043)	(0.042)
Diversity × T95 × Emerging			0.001	0.001
			(0.001)	(0.001)
Emerging countries		0.395*	0.246	0.259
		(0.235)	(0.606)	(0.574)
T95	0.005	0.005	2.744**	0.896
	(0.021)	(0.021)	(1.185)	(1.518)
Emerging× T95			0.001	0.001
			(0.001)	(0.001)
Weighted average tariff rates (Tariff)	-0.033	-0.041	1.647***	1.452***
	(0.064)	(0.063)	(0.488)	(0.467)
Tariff×T95			-1.443***	-1.308***
			(0.491)	(0.477)
Tariff×T95×Emerging			1.040	0.001
			(0.791)	(0.001)
Share of Internet users in country level population	-0.011	-0.012	-0.002	0.006
	(0.009)	(0.009)	(0.028)	(0.025)
Internet users ×T95			0.044	0.018
			(0.033)	(0.033)
Internet users ×T95×Emerging			0.114	0.204
			(0.350)	(0.383)
Workers with tertiary education (TerEd)	0.025***	0.026***	-0.031***	-0.511*
	(0.005)	(0.005)	(0.003)	(0.271)
TerEd × T95				0.504*
				(0.271)
TerEd × T95 × Emerging				0.662
				(0.478)
GDP growth rate	0.007	0.006	-0.049***	-0.022*
	(0.009)	(0.009)	(0.007)	(013)
No. of observations	141	141	141	141
Wald chi squared	671.35	661.89	2,037.81.	1,188.82
Log Likelihood	-9.319332	-8.191908	-.2,535294	-3.512823
Probability> chi squared	0.000	0.000	0.000	0.000

Note: In the generalized least square model, we control for autocorrelation and heteroskedasticity. We report robust standard errors in parentheses and report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. In columns 1 and 2, we present regression results of determinant models and in columns 3 and 4 we present regression results of interaction models. Our constructed binary variable T95 takes on a value of 1 for years ≥ 1995, and zero (0) otherwise.

DOI: 10.7885/1946-651X.1042

In the base line model in Table 2 column 1, we found that one of the control variables, the GDP growth rate was not statistically significant at conventional levels. Important determinants such as political stability, the patent rights index, ethnic diversity and the dummy for emerging market countries all displayed positive direct effects on international R&D investments, in keeping up with a priori expectations. Workers with tertiary education had a bi-directional effect on international R&D flows. Contrary to expectations, weighted average tariffs and share of internet users were not significant in the direct effects model in column 1 and 2 of Table 2. The coefficients for political stability, ethnic diversity and the patent rights index remained positive even in the variant (interaction effects) specifications of the models presented in columns 3 and 4. Surprisingly, the weighted average tariffs term which did not exhibit statistically significant direct effects became significant in the variant interaction models, implying a negative impact of tariff barriers on transnational R&D flows. This result supported our a priori expectations. Likewise, the GDP growth rate which did not exhibit any direct effects, became negative and statistically significant in the variant effects model.

The direct effects of variable T95 were positive across all four regressions result presented in column 1 through column 4 of Table 2. However, the impact of T95 (proxy for variable for globalization) is statistically significant only in the regression results in column 3. The estimated coefficient of the variable 'share of internet users as percent of total population is not significant any of the four regressions shown in columns 1, 2, 3, and 4 of Table 2.

As observed in columns 1 through 4 of Table 2, the values of the regressions coefficients for political stability are positive and significant suggesting that political stability is instrumental in attracting international R&D inflows. However the positive effects of political stability on R&D flows have diminished since 1995, as the negative signs for the interaction terms in columns 3 and 4 indicate (only the coefficient in column 3 is statistically significant).

The impact of patent rights index on international R&D flows was positive as expected (see columns 1, 2 and 4). However, the interaction terms of patent rights with T95 as well as with emerging markets were insignificant (see columns 3 and 4).

The estimated coefficients for the variable tariff rate were positive and statistically significant in column 3 and 4 implying that tariff increases can sometimes increase international R&D flows. This could occur when international R&D flows and FDI are substitutes and/or where transnational R&D investments enjoy some fiscal incentives relative to FDI. Another interesting result was the interaction of T95 with workers with tertiary education in column 4. The estimated coefficient of this variable is positive and significant implying that the effectiveness of human capital endowments in attracting foreign R&D investment has increased after 1995 due to globalization. However, the coefficient for the variable TerEd × T95 × Emerging was not statistically significant suggesting that this effect did not extend to emerging market countries.

We now turn to a discussion of the Conclusions.

CONCLUSIONS

Among the most notable observations obtaining from the study was the strong effect of 'ethnic diversity' on international R&D inflows. This variable was significant in all four regressions suggesting that an ethnically diverse country is more open and conducive to receiving international R&D investment flows. This is a variable that has hitherto received scant attention in the literature on Foreign Direct Investment and on international R&D flows. While the effects manifested by ethnic diversity do not appear to have increased significantly with globalization (note the interaction with 'T95'), especially among emerging market countries, ours was only an exploratory study. Future research needs to build on these tentative findings and explore the effects of this variable in greater detail. As expected, a country's political stability was instrumental in attracting international R&D inflows. Surprisingly though, this positive impact of political stability appears to have reversed with increased globalization (note the negative interaction term with T95 in column 3). While we can offer no explanation for this result, it is plausible that given the increased importance of some countries with alternative political systems in the world economy, R&D investments of MNCs might have been making their way into these non-traditional locations since 1995. Further research is needed to get to the bottom of this confounding result.

We observe that improved patent rights enforcement improves R&D investment inflows. These findings contrast with Jaumotte et al.'s (2005) results. However they lend added support to Veliyath and Sambharya's (2011) previous findings. Another interesting observation was that effectiveness of patent rights as a determinant of transnational R&D investments appears to have diminished (i.e., based on the negative sign in the interaction terms) in emerging market countries in the period since 1995. This is a cause for concern since these emerging market countries are becoming important players in the world economy's sector-specific trade in technology and in services. Given this finding and the conflicting evidence from multiple previous studies, future research should investigate the role of this variable in greater detail.

The dummy variable for emerging market countries was positive in all three regressions, as we note from the results presented in columns 1 through 4 (although the regression coefficient was statistically significant only in column 2). This result implies that emerging market countries are increasingly becoming favored destinations for R&D investments by foreign affiliates of MNCs. The positive sign for the coefficient of T95 (with significance in column 3) lends some support to our a priori expectation that since 1995, the greater pace of globalization has fostered international R&D investment flows. Nonetheless, the impact of globalization is still a work-in-progress and data covering a more recent span of time is perhaps required to fully understand the impact of globalization on international R&D investment flows.

DOI: 10.7885/1946-651X.1042

The overall insignificance of the variable internet users as share of population (i.e., ICT) appears to confirm some of the previous findings (e.g., Spiezia, 2011; Cerquera and Klein, 2008) that ICTs do not necessarily augment 'inventive' capabilities of firms. Further, international R&D flows do not seem appear to be impacted by whether a country has a greater share of internet users. This is a surprising and counter-intuitive result that merits further inquiry by future research. Increased tariff barriers appear to engender increased international R&D flows (as reported in column 3 and 4 of Table 2). However, with increased globalization (i.e., since 1995), the impact of tariffs on international R&D investments appears to have reversed (viz., note the negative interactions of tariff with T95 in columns 3 and 4 of Table 2). These results suggest that since 1995, reductions in tariff barriers have enabled countries to attract greater international R&D investments from MNCs' foreign affiliates. This is again a notable observation. Future research could perhaps help to unravel the reasons underlying this result. Finally, the role of human capital and a highly educated workforce in attracting R&D inflows appears to be positive (i.e., in columns 1 and 2 of Table 2) supporting our a priori contentions. However, estimated coefficient of this variable displays a negative influence on international R&D investment flows in the variant models in column 3 and 4, a finding that is counterintuitive and contrary to expectations.

Overall the study has uncovered a number of factors that appear to affect international R&D inflows. The overall significance of the regression models attests to the strength and explanatory power of the results. There were a number of surprising results that need further investigation by future research. Ours was only an exploratory study and missing values in the data set might have accounted for some of the observed discrepancies. That is a limitation of the current study. However, we believe that our study can serve as a point of departure for further inquiry into a number of research questions that have been identified above. We also believe that more intuitive and statistically significant results can be obtained with panel data that includes more countries and a more recent time horizon.

References

Allred, B. B., & Park, W. G. (2007). Patent rights and innovative activity: Evidence from national and firm-level data. *Journal of International Business Studies*, 38, pp. 878-900.

Archibugi, D., & Coco, A. (2005). Measuring technological capabilities at the country level: A survey and menu for choice. *Research Policy*, 34(2), pp. 175-194.

Archibugi, D., & Coco, A. (2004). A new indicator of technological capabilities for developed and developing countries. *World Development, 32*(4), 629-654.

Baldwin, J. R., & Gu, W. (2004). Trade liberalization: Export-market participation, productivity growth, and innovation. *Oxford Review of Economic Policy, 20*(3), 372-392.

Bascavusoglu, E. (2005). Does international trade transfer technology to emerging markets? A patent citation analysis (working paper no. 14): The Open University Research Center on Innovation, Knowledge and Development, United Kingdom.

Cerquera, D., & Klein, G. J. (2008). Endogenous firm heterogeneity, ICT and R&D incentives: ZEW Discussion Paper no. 08-126.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly, 35*, 128-152.

Dalton, D. H., & Serapio, M. G. (1999). Globalizing industrial research and development. Washington D. C.: Office of Technology Policy, US Department of Commerce.

Doh, J.P., Jones, G. K., Mudambi, R., & Teegen, H. (2005). Foreign research and development and host country environments: An empirical examination of U.S. international R&D. *Management International Review*, 45(2), pp. 121-154.

Ernst, D. (2005). *Complexity and internationalization of innovation: the root causes*: United Nations' Conference on Trade and Development (UNCTAD).

Feinberg, S.E., & Gupta, A.K. (2004). Knowledge spillovers and the assignment of R&D responsibilities to foreign subsidiaries. *Strategic Management Journal*, 25 (8-9), pp. 823-845.

Florida, R. (1997). The globalization of R&D: Results of a survey of foreign-affiliated R&D laboratories in the USA. *Research Policy*, 26(1), 85-103.

Fujita, M., & Thisse, J.-F. (2006). Globalization and the evolution of the supply chain: Who gains and who loses? *International Economic Review, 47*(3), 811-836.

Furman, J. L., & Hayes, R. (2004). Catching up or standing still? National innovative productivity among 'follower' countries, 1978-1999. *Research Policy*, 33(9), pp. 1329-1354.

Gallie, E. P., & Roux, P. (2010). Forms and determinants of R & D collaborations: Evidence based on French data. *Industry and Innovation, 17*(6), 551-576.

Gallie, E.-P., & Roux, P. (2008). *Forms and determinants of R&D collaborations: New Evidence on French Data*: DRIUD.

Garcia-Vega, M., & Huergo, E. (2011). Determinants of International R&D Outsourcing: The Role of Trade. *Review of Development Economics*, 15(1), 93-107.

Ginarte, J. C., & Park, W. G. (1997). Determinants of patent rights: A cross-national study. *Research Policy*, 26, pp.283-301.

Globerman, S., & Shapiro, D. (2003). Governance infrastructure and U.S. foreign direct investment. *Journal of International Business Studies*, 34(1), pp. 19-39.

Grosse, R., & Trevino, L. J. (2005). New institutional economics and FDI location in Central and Eastern Europe. *Management International Review*, 45(2), pp. 123-145.

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042

Grossman, G., & Helpman, E. (1991). *Innovation and Growth in the Global Economy*. Cambridge, MA: MIT Press.

Grossman, G. M., & Maggi, G. (2000). Diversity and Trade. *American EconomicReview, 90*(5), 1255-1275.

Grupp, H., & Schmoch, U. (1999). Patent statistics in the age of globalization: new legal procedures, new analytical methods, new economic interpretation. *Research Policy*, 28, pp. 377-396.

Guellec, D., & van Pottelsberghe de la Potterie, B. (2001). R&D and productivity growth: Panel data analysis of 16 OECD countries OECD economic studies. Organization of Economic Cooperation and Development (OECD).

Hummels, D. (2007). Transportation costs and international Trade in the second era of globalization. *The Journal of Economic Perspectives, 21*(3), 131-154.

Hu, Mei-Chih., and Mathews, J.A. (2005). National innovative capacity in East Asia. *Research Policy*, 34(9), pp. 1322-1349.

Hunt, J., & Gauthier-Loiselle, M. (2010). How Much does immigration boost innovation? *American Economic Journal: Macroeconomics, 2*(2), 31-56.

Isaksson, A. (2007). *Determinants of Total Factor Productivity: A Literature Review*: UNIDO.

Jaumotte, F., & Pain, N. (2005). From ideas to development: The determinants of R&D and patenting: OECD Economics Department Working Papers.

Jones, G. K., & Teegen, H. J. (2003). Factors affecting foreign R&D location decisions: management and host policy implications. *International Journal of Technology Management,* 25(8), pp. 791-813.

Kafouros, M. L. (2006). The impact of R&D on efficiency: theory and evidence. *Technovation, 26*(7), 827-835.

Kaufman, D., Kraay, A. & Mastruzzi, M. (2005). Governance matters IV: Governance indicators for 1996-2004. Washington D. C.: World Bank.

Krugman, P. R. (1984). Import protection as export promotion: International competition in the presence of oligopoly and economies of scale. In H. Kierzkowski (Ed.), *Monopolistic Competition in the Presence of Oligopoly and Economies of Scale*. Oxford: Oxford University Press: pp. 180-193.

Kumar, N. (2002). *Globalization and the quality of foreign direct investment*. Oxford University Press.

Kumar, N. (2001). Determinants of location of overseas R&D activity of multinational enterprises: the case of US and Japanese corporations. *Research Policy*, 30(1), 159-174.

Kumar, N. (1996). Intellectual property protection, market orientation, and location of overseas R&D activities by multinational enterprises. *World Development,* 24(4), pp. 673-688.

Lall, S. (2001). Competitiveness indices and developing countries: An economic evaluation of the Global Competitiveness Report. *World Development,* 29(9), pp. 1501-1525.

Lee, J. Y., & Kim, J. W. (2006). Total factor productivity and R&D capital in manufacturing industries: East West Center, University of Hawaii.

Liu, X. (2009). GATT/WTO promotes trade strongly: Sample selection and model specification. *Review of International Economics, 17*(2), 428-446.

Liebman, B. H., & Reynolds, K. M. (2010). Innovation through Protection: Does Safeguard Protection Increase Investment in Research and Development? : U.S. International Trade Commission.

Litchtenberg, F., & Potterie, B. v. P. d. l. (1996). International R&D spillovers: A reexamination: NBER.

Loree, D. W., & Guisinger, S. E. (1995). Policy and non-policy determinants of US equity foreign direct investment. *Journal of International Business Studies*, 26, pp. 281-299.

Long, N. V., Raff, H., & Stahler, F. (2011). Innovation and trade with indigenous firms. *Journal of International Economics, 84*(2), 149-159.

Lumenga-Neso, O., Olarreaga, M., & Schiff, M. (2005). On 'indirect' trade-related R&D spillover. *European Economic Review, 49*(7), 1785-1798.

Lundvall, B., Johnson, B., Andersen, E. S., & Dalum, B. (2002). National systems of production, innovation and competence building. *Research Policy*, 31(2), pp. 213-231.

MacGarvie, M. (2004). The determinants of international knowledge diffusion as measured by patent citations. *Economics Letters, 87*(1), 121-126.

Mahmood, I. P., & Singh, J. (2003). Technological dynamism in Asia. *Research Policy*, 32(6), pp. 1031-1054.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics, 107*(2), 407-437.

Meyer, J. W., & Rowan, B. (1977). Institutional organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 80, pp. 340-363.

Murtha, T.P., & Lenway, S.A. (1994). Country capabilities and the strategic state: How national political institutions affect multinational corporations' strategies. *Strategic Management Journal*, 15, pp. 113-130.

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042

Narula, R. (2004). Globalization and trends in international R&D alliances. *Journal of International Management, 10*(2), 199-218.

Nelson, R. R. (2008). What enables rapid economic progress: What are the needed institutions? *Research Policy*, 37(1), pp. 1-11.

Niebuhr, A. (2010). Migration and innovation: Does cultural diversity matter for regional R&D activity? *Papers in Regional Science 89*(3), 563-585.

North, D.C. (1990). *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, Cambridge.

Ostergard, R. L. Jr. (2000). The measurement of intellectual property rights protection. *Journal of International Business Studies*, 3(2), pp. 349-360.

Pajunen, K. (2008). Institutions and inflows of foreign direct investment: A fuzzy-set analysis. *Journal of International Business Studies*, 39, pp. 652-669.

Polder, M. G., Van Leeuwen, P., Mohnen, P., & Raymond, W. (2009). *Productivity Effects of Innovation Modes*: Statistics Netherlands Discussion Paper no. 09033.

Pearce, R. D. (1999). Decentralized R&D and strategic competitiveness: globalized approaches to generation and use of technology in multinational enterprises (MNEs). *Research Policy, 28*(2-3), 151-178.

Reddy, P. (2005). *R&D-related FDI in developing countries: implications for developing countries*. Geneva: UNCTAD.

Reddy, P. (1997a). New trends in globalization of corporate R & D and implications for innovation capability in host countries: A survey from India. *World Development*, 25(11), 1821-1837.

Reddy, P., & Sigurdson, J. (1997b). Strategic location of R&D and emerging patterns of globalization: the case of Astra Research Centre India. *International Journal of Technology Management*, 14(2-4), 344-361.

Reitzes, J. D. (1991). The impact of quotas and tariffs on strategic R&D behavior. *International Economic Review, 32*(4), 985-1007.

Romer, P. M. (1994). The Origins of endogenous growth. *Journal of Economic Perspectives 8*(1), 3-33.

Roy, S., & Acharyya, R. (2009). Innovation under the threat of direct foreign investment. *Journal of Economic Development, 34*(1), 81-98.

Savvides, A., & Zachariadis, M. (2003). International technology diffusion and the growth of TFP in the manufacturing sector of developing economies: Department of Economics, Yale University.

Scott, W.R. (2001). *Institutions and Organizations.* Sage, Thousand Oaks, CA.

Storper, M. (2000). Globalization, localization, and trade. In G. Clark, M. Feldman & M. Gertler (Eds.), *A Handbook of Economic Geography* (pp. 146-169): Oxford University Press.

Spiezia, V. (2011) Are ICT users more innovative? An analysis of ICT-enabled innovation in OECD firms. (pp. 1-20): ZEW Discussion Paper.

Storper, M. (2000). Globalization, localization, and trade. In G. Clark, M. Feldman & M. Gertler (Eds.), *A Handbook of Economic Geography* (pp. 146-169): Oxford University Press.

UNCTAD. (2005a). Globalization of R&D and developing countries. Geneva: United Nations.

UNCTAD (2005b). World investment report: Transnational corporations and the internationalization of R&D. Geneva: United Nations.

Veliyath, R., & Sambharya, R. B. (2011). R&D investments of multinational corporations: An examination of shifts in patterns of flows across countries and potential influences. *Management International Review, 51*(3), 407-428.

Wang, E. C. (2010). Determinants of R&D investment: The extreme-bounds-analysis approach applied to 26 OECD countries. *Research Policy, 39*(1), 103-116.

Zietz, J., & Fayissa, B. (1992). R&D expenditures and import competition: Some evidence from the United States. *Review of World Economics, 128*(1), 155-164.

https://digitalcommons.kennesaw.edu/jekem/vol3/iss1/9
DOI: 10.7885/1946-651X.1042