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Título del trabajo: Opening the black box of innovation in R&D-intensive industries: The role of internationalization and institutional development

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ABSTRACT

This study draws from the learning by exporting literature and institutional theory in predicting innovation behaviour of firms. On the one hand, we examine how the level of internationalization of a firm affects its innovative efforts. We expect international firms to be able to access information not available in their home countries and expect them to use such knowledge in developing their products, processes and business models. On the other hand, we explore how a firm's home country institutional development influences its level of innovation. We expect firms from countries with more developed market intermediaries, political systems and business regulations to be more innovative than firms from less institutionally developed nations.

We test our hypotheses on a sample of 441 pharmaceutical and biotechnology firms from 34 developed, emerging and developing countries. These industries offer an interesting setting for our study as they are characterized by increasing globalization and extensive investments in research and development (R&D). Our results provide empirical support for both internationalization and home country institutional development as drivers of innovation at the firm-level. Our study has various implications for theory and practitioners. We extend current understanding by showing that the theories of learning by exporting and stronger institutions as innovation drivers hold true for firms in the R&D-intensive, global pharmaceutical and biotechnology industries. We show that by increasing their degree of internationalization, firms may be able to gain new knowledge and as a result become more innovative. In relation to government policies, we suggest that governments can enhance the level of R&D investments and innovation among domestic firms not only through policies that promote innovation but also through those that foster international trade.

Keywords: innovation, internationalization, institutional development, home country institutional profile, emerging and developing economies, pharmaceutical and biotechnology industries

RESUMEN

Este estudio se basa en la literatura del aprendizaje a través de exportación y la teoría institucional para predecir el comportamiento innovador de las empresas. Por un lado, examinamos cómo el nivel de internacionalización de una empresa afecta sus esfuerzos innovadores. Esperamos que las firmas internacionales puedan acceder a información que no está disponible en sus países de origen y esperamos que usen dicho conocimiento para desarrollar sus productos, procesos y modelos de negocio. Por otro lado, exploramos cómo el desarrollo institucional del país de origen de una empresa influye en su nivel de innovación. Esperamos que las empresas de países con mejores intermediarios de mercado, sistemas políticos y regulaciones comerciales sean más innovadoras que las empresas de países menos desarrollados.

Evaluamos nuestras hipótesis en una muestra de 441 empresas farmacéuticas y biotecnológicas de 34 países desarrollados, emergentes y en vías de desarrollo. Estas industrias ofrecen un entorno interesante para nuestro estudio, ya que se caracterizan por una creciente globalización y grandes inversiones en investigación y desarrollo (I+D). Nuestros resultados brindan apoyo empírico para la internacionalización y el desarrollo institucional del país de origen como impulsores de la innovación a nivel de empresa. Nuestro estudio tiene varias implicaciones para la teoría y los profesionales. Extendemos la teoría demostrando que las ideas del aprendizaje a través de exportación y las instituciones más fuertes como impulsores de la innovación son ciertas para las empresas en las industrias farmacéuticas y de biotecnología intensivas en I+D. Mostramos que al aumentar su grado de internacionalización, las empresas pueden obtener nuevos conocimientos y, como resultado, ser más innovadoras. En relación con las políticas gubernamentales, sugerimos que los gobiernos pueden mejorar el nivel de inversión e innovación en I+D entre las empresas nacionales, no solo a través de políticas que promueven la innovación, sino también aquellas que fomentan el comercio internacional.

Palabras clave: innovación, internacionalización, desarrollo institucional, perfil institucional del país de origen, economías emergentes y en vías de desarrollo, industria farmacéutica y de biotecnología

I. INTRODUCTION

Innovation is said to be vital for a firm's success. By innovating, firms can make their operational processes more efficient, improve their existing products and business models or develop new ones, and expand their customer base by catering for more needs. Essentially, innovation is the key for profitable growth in today's fast-paced digitalized world. Firms that do not innovate and improve their products and processes will eventually be overtaken by their rivals (Porter, 1990). Innovation is not a new phenomenon. Early examples of innovations that have been developed to solve an existing problem include scissors, democracy and smallpox vaccine. These statements have even more relevance to firms belonging to R&D-intensive industries, such as pharmaceutical and biotechnology firms.

In this vein, the academic literature has been interested in studying internationalization as a driver of innovation (e.g. Hitt, Hoskisson & Kim, 1997; Salomon & Shaver, 2005). An OECD study (Kiriya, 2011) stressed the role of internationalization in the current innovation challenges of the pharmaceutical and biotechnology industries. Kiriya (2011: 5) notes that "revenues from global sales have provided incentives and funds for R&D investment for future innovation. Global sales of pharmaceutical products, in turn, mean global diffusion of advanced medical technology and benefit importers in terms of improved health, an essential basis for future growth and innovative capacity".

On the other hand, a line of research emerged along with Porter's (1990) seminal work on national competitiveness, which views firms' innovativeness and the consequent competitive success as a function of their home countries' characteristics, such as available factors and the sophistication of national buyers. Recent studies have researched innovation as being enforced or hindered by the host country in which the firm operates or the institutional distance between the home and host countries (see e.g. Wu, 2013; Wu, Wang, Hong, Piperopoulos & Zhuo, 2016).

Although Rugman & Verbeke (1993) called for research combining the national determinants of innovation with international influences, few studies have integrated these two antecedents (see the meta-analysis of Hitt, Tihanyi, Miller & Connelly, 2006). Notable exceptions include Xie & Li (2018) who found that support for R&D and development of market intermediaries in the firm's home region positively moderated the relationship between exporting and innovation. However, as the study is limited to firms from different regions within China, the authors call for future research in a more global context.

We aim to fill this gap by examining how a firm's level of internationalization and its home country institutional development influence innovation. So, building on institutional theory and organizational learning, we propose that both the volume of international operations and stronger home country institutions positively affect firms' innovativeness. We look at both macro and micro-level factors because both have been found to play an important role in determining how firms innovate.

We test our hypotheses on a sample of 441 pharmaceutical and biotechnology firms from 34 countries, including developed, emerging and developing economies. Given that pharmaceutical and biotechnology industries are R&D-intensive and with higher global sales, our sample provides an excellent context to test the goals of this study. Additionally, the fact that our sample covers firms from developed and less developed countries is of special relevance because it will allow a wider generalization of our conclusions.

We contribute to the existing literature in several ways. First, by combining the theory on organizational learning and the institutional perspective, we show that firms with international operations are more innovative than their purely domestic compatriots and that, *ceteris paribus*, firms with better developed institutions at home exceed their competitors from less developed countries in terms of their level of innovation. Second, we contribute to the existing learning by exporting literature by suggesting that the strength of such learning depends on both internal firm-specific characteristics and external country-specific factors. Third, our sample of firms in the pharmaceutical and biotechnology industries from different countries presents an interesting framework because these industries have experienced a process of

profound transformation. Emerging and developing economies are increasingly important markets for pharmaceutical and biotechnology firms, and our paper allows us to analyze whether such markets also involve more active participants in the R&D process. Finally, we suggest various lines of future research to extend and complement our findings.

This paper is structured as follows. The following section reviews literature and presents our hypotheses. The third section describes the sample and measures of the variables. We then describe the main results of the study. The last section concludes and discusses limitations and potential avenues for future research.

II. THEORETICAL BACKGROUND

Internationalization as a strategy

Strategic management literature states that firms can essentially expand their operations in two ways: by diversifying their product or service offering or by diversifying their operations outside the home market (Wan & Hoskisson, 2003). Internationalization can be defined as a strategy “through which a firm expands the sales of its goods or services across the borders of global regions and countries into different geographic locations or markets” (Hitt, Ireland, & Hoskisson, 2008: 231). There is vast research in the international business literature on the firm-level advantages and disadvantages of internationalization. Most researchers agree that internationalization increases the profitability of a firm. The new markets accessed through international expansion increase the customer base, thus allowing for the distribution of costs between countries. The increased market size also allows firms to gain faster and higher returns on investments, which is especially important in R&D-intensive industries and industries with fast technological advances (e.g. Hitt et al., 2008).

However, on the one hand, exposure to foreign markets can create challenges for firms. Johanson & Vahlne (1977, 2009) warn about the liability of foreignness and posit that in order for firms to successfully operate in foreign markets, they need to understand how these markets work and establish business relationships with suppliers and customers. There is a disadvantage in being foreign, which can present itself in the form of higher costs and discrimination (Cuervo-Cazurra, Ciravegna, Melgarejo & Lopez, 2018; Golovko & Valentini, 2011). It can be challenging for firms to coordinate and manage activities between different locations due to geographical distance and differences in culture and business practices (Hitt et al., 1997). Communications have also been found to deteriorate in terms of efficiency and quality as teams become more geographically disperse (Kafourous, Buckley, Sharp, & Wang, 2008).

On the other hand, firms can also experience difficulties when faced with the complex regulatory environment of their new, multi-country operations. As the firm internationalizes, the number of stakeholders increases and their diverse interests create increased external pressure for the firm (Marano, Tashman & Kostova, 2017). To overcome these challenges, managers across countries must interact both internally with each other and externally with suppliers, government officials etc., thus increasing transaction costs. Moreover, firms need to process a large amount of information to successfully operate in an international environment (Hitt et al., 1997). Nevertheless, the new information technologies that these internationalizing firms have access to, can give them a competitive advantage over their purely domestic rivals. So, the increased globalization of the markets and the technological advances in communications make it easier for firms to penetrate new international markets.

In conclusion, despite the drawbacks that internationalization can bring with it, firms are encouraged to expand their operations to other markets in order to diversify the risk and obtain higher returns (e.g. Hitt et al., 2006). Internationalization enables firms to quickly increase the stock of existing knowledge, and the availability of resources helps firms achieve competitive advantage. The following section focuses on the influence of internationalization on the development of innovations.

The internationalization-innovation relationship

There is vast theoretical and empirical support for the existence of a relationship between internationalization and innovation. According to the learning by exporting theory (Salomon & Shaver, 2005), international firms gain access to knowledge and technologies that are not available in the home market, and this new learning enables them to improve their products and processes. By gaining access to more diverse resources and information sources and by establishing relationships with local businesses and research institutions, firms can better develop innovations and thus increase their profitability (Chittoor, Aulakh & Ray 2015; Kafouros et al., 2008). Examples of sources of information for the internationalizing firm include customer feedback, competing products and technologies used by buyers and suppliers (Salomon & Shaver, 2005). Filippetti, Frenz & Ietto-Gillies (2017) argue that this learning process depends on the firm's absorptive capacity as well as its industry's

and home country's absorptive capacity. On the firm-level such capacity, defined as the "ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990: 128), is accumulated over time and depends on the prior related knowledge the firm has.

In this vein, Gereffi (1999) found that firms innovated as a result of information exchange and learning between buyers, sellers and manufacturers. Foreign markets also present opportunities for networking and cooperation with local universities and research facilities (Santos, Doz & Williamson, 2004). The newly acquired knowledge can help the firm improve its products and processes to gain competitive advantages, and thus enhance its performance in both the domestic and foreign markets. As purely domestic firms do not have access to such information, we expect more international firms to have higher levels of innovation.

However, not all of the studies point to a one-directional relationship from internationalization to innovation. Some authors argue that firms with the highest levels of innovation consciously self-select to become exporters, thus exhibiting a reverse causality (Filippetti et al., 2017). Golovko & Valentini (2011) find that exporting and innovation are complementary strategic activities, and that the adoption of one of these strategies is likely to be followed by the other. The majority of researchers agree, nonetheless, that the extent to which a firm's operations are conducted in foreign markets drives its level of innovation (e.g. Cassiman & Golovko, 2011; Chittoor et al., 2015; Kafourous et al., 2008).

Hence, having operations outside the home country will generally expand the revenue base of a firm, and increased sales are likely to provide the firm with more resources to invest in innovation. As the global competitive landscape requires firms to innovate in order to achieve and maintain competitive advantage (Hitt et al., 1997), the greater market size achieved through internationalization provides more resources for doing so. On the other hand, increased demand from the foreign market allows the firm to commercialize its innovations to a broader audience, thus increasing the returns on innovation (Alvarez & Robertson, 2004). As a whole, we expect the greater resources and knowledge offered by internationalization to positively impact the innovative efforts of firms.

Hypothesis 1. *The degree of internationalization of a firm is positively associated with its level of innovation.*

Home country institutional profile

According to the institutional theory there are differences in the way firms from distinct countries behave and make strategic decisions. In his seminal work, North (1990) described how each country is a sum of its institutions and how these institutions form the basis for societal structure and guide the behavior within the society. The legal, political, administrative and economic framework of the country constitutes formal institutions, whereas informal institutions refer to societal norms and beliefs which are not enforced by law nor documented (Marano, Arregle, Hitt, Spadafora & van Essen, 2016; North 1990; Scott 1995). Wan & Hoskisson (2003) integrate North's (1990) institutional view with a more traditional economics perspective on production factors in their concept of home country environment. They consider various production factors, such as labor quality, infrastructure and natural resources, together with formal and informal institutions to determine the opportunity set available for firms in an economy (North, 1990).

There is a growing literature examining the relationship between the characteristics of home country institutional development and firms' behavior and performance. Specifically, two theoretical perspectives have emerged to explain how the development of formal institutions in a firm's home country affects its strategic decisions, such as the decision to invest in R&D. In the first one (Porter, 1990; Rugman & Verbeke, 1993), firms from more institutionally developed countries are seen as more competitive due to their location advantages. These include the availability of specialized resources and skilled labor, the existence of related industries and the exchange of market and strategic information, the external pressures from more demanding buyers, and advanced management practices as well as increased competition among domestic firms (Cuervo-Cazurra & Ramamurti, 2017; Porter, 1990). Ultimately, the government of a country has the power to influence and strengthen these country-specific advantages through pro-investment and antitrust policies, deregulation of competition as well as a focus on education

and standardization (Marano et al., 2016; Porter, 1990). Firms develop “particular resources at home to deal with characteristic conditions of the environment there and these resources are then used by the firm in its international expansion” (Cuervo-Cazurra, 2011: 384). In general, developed countries are characterized by a higher level of institutional development, whereas emerging and developing countries have weaker institutions. Emerging and developing market firms often face challenges and increased transaction costs due to institutional voids, i.e. the lack of or improper functioning of institutions in the product, capital and labor markets (Khanna & Palepu, 1997). Also, they often lack high-quality market intermediaries, such as brokers and accounting firms (Xie & Li, 2018). Their competitiveness is also weakened by political problems, such as instability and unpredictability, corruption and bureaucracy (Luo & Tung, 2007).

The second theoretical perspective suggests that location *dis*advantages may lead to firm-specific advantages (e.g. Cuervo-Cazurra et al., 2018; Cuervo-Cazurra & Ramamurti, 2017; Wu et al. 2016). This point of view stresses that institutional voids drive firms to expand into more developed markets in order to benefit from the institutional advantages and technological knowledge there (Wu, 2013). As a response to institutional weaknesses in their home country, firms develop new products, processes or business models that “involve novel and innovative combinations of existing knowledge and technologies to solve pressing local problems” (Govindarajan & Ramamurti, 2011: 193). Such innovations are often demanded not just by other emerging markets but also by developed countries due to their affordability and new features, such as portability and ease of use (Cuervo-Cazurra & Ramamurti, 2017). Furthermore, exposure to political risk and corruption in the home country drives emerging market firms to develop routines and strategic solutions to deal with their uncertain, unpredictable environments (Cuervo-Cazurra et al., 2018). These coping skills help firms survive and succeed in complex international markets.

Home country institutional development and innovation

Building on institutional theory, some researchers have noted that differences in the political and legal systems of firms’ home countries affect their levels of innovation.

The physical infrastructure, financial and capital resources, labor quality as well as the political, legal and societal institutions of a firm's home country have been found to influence firm strategies (Wan & Hoskisson, 2003). Firms from countries with high institutional development face tougher competition, which requires continuous innovation and specialized expertise to remain successful. This is in line with Porter's (1990) findings on competitive advantage being driven by innovation.

Porter (1990) argues that governments have the power to push a country towards innovativeness. They can do so by granting subsidies or tax incentives, enforcing standards, as well as by promoting competition, antitrust laws and open trade. Government financial support provides firms with resources to innovate and helps mitigate the risk of unsuccessful projects (Xie & Li, 2018). In their longitudinal study, Furman, Porter & Stern (2001) found that those countries that encouraged competition and investments in technical universities increased their innovative capacity. Furthermore, as firms in less developed countries have to invest time and resources in dealing with the unpredictable and unstable government, they are left with fewer resources to assign to innovation (Wu, 2013).

The innovations of emerging and developing market firms are often fundamentally different from those of developed market firms. It is argued that institutional voids present in less developed economies and the lower per capita income of citizens drive innovations for inexpensive, portable and easy-to-use products (Govindarajan & Ramamurti, 2011). These products are focused on solving some of the inherent problems of emerging economies, such as poor road infrastructure or unreliable supply of electricity (Cuervo-Cazurra & Ramamurti, 2016). However, most scholars agree that although firms from economies with weak institutions make investments in R&D, their innovative efforts fall short of those of their more developed country counterparts. In line with prior research, we hypothesize that the level of institutional development of the firms' home countries positively affects their level of innovation.

Hypothesis 2. *The level of institutional development of a firm's home country is positively associated with the firm's level of innovation.*

III. DATA AND VARIABLES

Data

We tested our hypotheses on firms in the pharmaceutical and biotechnology industries in multiple countries. The data was collected from Thomson Reuters Eikon, a database that includes a number of financial (e.g. income statement, balance sheet, statement of cash flows) and non-financial parameters (e.g. business and geographic segments, major customers). Thomson Reuters Eikon offers a comprehensive platform for establishing customizable benchmarks (e.g. sector and country) for the assessment of corporate performance. To our knowledge, the reliability of Thomson Reuters Eikon database has not been questioned in the academic community or among users of corporate information.

Our original sample consisted of all the firms of the database that operate in the healthcare industry worldwide (3964 firms). This industry includes the pharmaceutical and biotechnology sub-industries. These sub-industries were chosen as they are known to be highly research-intensive, which makes them suitable for examining the R&D process and outcomes. OECD has stressed that internationalization is one of the most important challenges of these industries and can be an important fosterer of innovation (Kiriya, 2011).

Due to limitations in the availability of data on our key variables and the exclusion of atypical observations, the final sample size amounted to 441 (see Table 1). Table 1 shows our final sample distributed among sub-industries and countries as follows. The majority of firms, 73%, operate in the pharmaceutical sub-industry while the remaining 23% belong to the biotechnology sub-industry. The sample includes firms from all five continents, although the clear leader in terms of number of firms is Asia (317), followed by Europe (67) and the Americas (44). China is the country with the highest number of firms in our sample (195), amounting to 44.2% of the total. Other well-represented countries in the sample include the United States with 34 firms and Taiwan with 30 firms. China is the most represented country in both the pharmaceutical and biotech sub-industries.

Table 1. Summary descriptive statistics of the final sample. For a full breakdown see Appendix B.

Region of Headquarters			GICS Industry Name		Total
			Biotechnology	Pharmaceuticals	
Africa	Country of Headquarters	South Africa	0	1	1
	Total		0	1	1
Americas	Country of Headquarters	United States	20	15	34
		Canada	2	7	9
		Argentina	1	0	1
	Total		23	22	44
Asia	Country of Headquarters	China	37	158	195
		Taiwan	8	22	30
		Korea, Republic	9	16	25
		India	1	24	25
		Japan	5	20	25
		Others	3	14	17
	Total		63	254	317
Europe	Country of Headquarters	United Kingdom	3	12	15
		Sweden	7	3	10
		Ireland	2	5	7
		Denmark	3	3	6
		Germany	3	3	6
		Others	9	14	23
	Total		27	40	67
Oceania	Country of Headquarters	Australia	6	4	10
		New Zealand	0	1	1
	Total		6	5	11
Total			119	322	441

Variables

Dependent variable

In this study we aim to explain the variable *innovation*. Innovation can be measured in terms of input or output. Input measures include the expenditure in R&D, while output measures range from patents to new products and processes (Filippetti et al., 2017). We are interested in the amount of investments made in innovation which “involve the commitment of financial resources in the short run on the expectation of future positive returns” (Golovko & Valentini, 2011: 366). We choose an input measure as it represents the willingness of a firm to innovate, as opposed to output measures, such as the number of patents, that quantify the success of the innovative efforts of a firm. The number of patents, for instance, has been criticized as a

measure because not all inventions can be patented (Kafouros et al., 2008). Furthermore, as the sample consists of firms operating in the pharmaceutical and biotech sub-industries, which are characterized by relatively low success rates, the use of input measures better quantifies the innovative efforts. We operationalize innovation as the ratio of total R&D expenses to total revenue to be able to compare firms of different sizes in a non-biased manner (Tyagi, Nauriyal & Gulati, 2018). We use the average of the last five years to take into account the long-term innovation strategy of the firms as opposed to any spontaneous, non-recurring increases or decreases in the expenditure.

Independent variables

The first independent variable of the study, *internationalization*, is measured as the ratio of international sales to total sales. This measure has been used widely in the research literature (e.g. Kafouros et al., 2008). Other studies have used measures such as the ratio of foreign assets to total assets or the number of foreign employees compared with total employees (Hitt et al., 2006). However, we operationalize internationalization as the ratio of foreign sales to total sales as this measure allows us to consider all entry modes from exporting to foreign direct investment. We use data from the most recent year available (2016).

Home country institutional profile, our second independent variable, is measured using the Worldwide Governance Indicators (WGI) of 2016, which consist of six dimensions: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption. Each dimension has values on a scale ranging from -2.5 to 2.5 with higher values indicating better governance. We use principal component analysis followed by other researchers (e.g. Globerman & Shapiro, 2003; Marano et al., 2017; Wu et al. 2016) to compute a single measure to quantify the home country institutional profile (see Table 2).

Table 2. Home country institutional profiles.

Country	Institutional Profile	Country	Institutional Profile
New Zealand	2.064	Taiwan	1.242
Switzerland	2.002	France	1.202
Finland	1.957	Slovenia	1.057
Sweden	1.951	Spain	0.978
Netherlands	1.884	Israel	0.927
Luxembourg	1.876	Cayman Islands	0.927
Canada	1.868	Poland	0.839
Denmark	1.867	Hungary	0.524
Singapore	1.815	South Africa	0.232
Australia	1.741	Argentina	-0.023
Germany	1.710	Jordan	-0.032
United Kingdom	1.611	India	-0.166
Hong Kong	1.602	Indonesia	-0.170
Ireland	1.583	Thailand	-0.283
Austria	1.578	China	-0.395
Japan	1.535	Russia	-0.755
Belgium	1.418	Korea, Republic	-1.781
United States	1.413		

Control variables

We use various control variables to take into consideration the effects of firm size, organizational slack, firm ownership and industry. Prior research acknowledges that firm size impacts the level of innovation of firms but disagrees on how (Xie & Li, 2018). We therefore control for *firm size* and measure it with the natural logarithm of total sales, consistent with the extant literature (Hitt et al., 1997). *Organizational slack*, defined as the surplus capacity held by a firm (Cyert & March, 1963), is proxied by the ratio of current assets to current liabilities. It might either encourage investments in long-term research projects or reduce the incentives to invest (Nohria & Gulati, 1997). We include a dummy variable for *state ownership* to account for any ownership effects on the level of R&D intensity. As state-owned firms often have non-economic goals as their main priority (Xie & Li, 2018), these might negatively affect their level of innovation. Those firms whose ultimate owner is the state are assigned a value of 1, whereas those that are mostly owned by non-state entities get the value 0. Furthermore, we use an *industry* dummy variable to distinguish between firms in the pharmaceutical and biotechnology sub-industries.

IV. RESULTS

We used ordinary least squares regressions in our analyses. Three models were used to test the hypotheses. Model I is the base model and tests all control variables with our dependent variable, the level of innovation. Model II adds our first independent variable, internationalization, into the regression. In Model III the second independent variable, home country institutional profile, replaces internationalization in the regression. Descriptive statistics of all variables are displayed in Table 3. The correlations between variables used in the same model do not indicate any multicollinearity issues and the variance inflation factors are within an acceptable range (1.06–1.20). The correlation between internationalization and home country institutional development is relatively high (0.59) but does not entail a problem, as these variables are not used simultaneously in the models. To avoid heteroskedasticity, we used robust standard errors in the regressions.

Table 3. Descriptive statistics and correlations.

	1	2	3	4	5	6	7
1 Innovation	1						
2 Firm size	-0.464**	1					
3 Organizational slack	0.241**	-0.381**	1				
4 State ownership	-0.063	0.155**	-0.104*	1			
5 Industry	0.114**	-0.349**	0.260**	-0.119**	1		
6 Internationalization	0.133**	-0.135**	0.004	-0.171**	0.126**	1	
7 Home country institutional development	0.215**	-0.157**	0.089*	-0.209**	0.264**	0.589**	1
Mean	0.115	18.951	3.184	0.070	0.270	0.196	0.360
Standard deviation	0.174	2.053	2.946	0.263	0.444	0.217	1.070
Min	0.000	14.130	0.510	0.000	0.000	0.000	-1.781
Max	1.000	25.010	24.460	1.000	1.000	1.000	2.064

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table 4 presents the results of our regressions. Model I shows a significant, positive relationship between the control variables and the dependent variable (adjusted $R^2 = 0.153$, $p < 0.001$). Unexpectedly, firm size was found to have a negative effect on the level of innovation at the 1% significance level. The coefficient for the variable organizational slack was statistically insignificant. The ownership status (state-owned versus privately owned firms) was found to have a significant, negative effect ($p < 0.001$) on the level of innovation, suggesting in line with prior research (e.g. Xie &

Li, 2018) that state-owned firms invest less in innovation. The industry dummy variable shows a positive and highly significant coefficient, indicating that biotechnology firms are more research-intensive than pharmaceuticals.

Model II, which adds the independent variable internationalization to the regression, is significant ($p < 0.001$) and the goodness of fit (adjusted R^2) improves to 0.189 compared with 0.145 of Model I. The level of internationalization was found to positively affect the level of innovation in firms. Thus, Hypothesis 1 was supported. Firm size had a negative, significant effect ($p < 0.05$) also in this model, indicating that larger firms spend less (in terms of percentage of sales) on R&D than smaller firms. The findings of prior research establish both negative and positive relationships between firm size and innovation (Xie & Li, 2018), which suggests that the relationship is more complex than it seems. The effect of organizational slack was not significant, suggesting that the firms' innovative efforts are not conditioned by their financial health. The state ownership dummy coefficient shows the expected sign (negative) and is significant. The control variable industry remains positive and significant, pointing to a higher level of innovativeness among biotechnology firms.

In Model III internationalization is eliminated and replaced with another independent variable, the home country institutional profile. This model is positive and significant (adjusted $R^2 = 0.259$, $p < 0.001$). The institutional profile of the firms' home countries was found to have a positive, significant effect ($p < 0.001$) on their innovative efforts, which provides support for Hypothesis 2. The coefficient for firm size was negative ($p < 0.001$) and the industry coefficient was positive and significant ($p < 0.001$), as in the previous models. State ownership had a negative, significant effect ($p < 0.001$) on the level of innovation, whereas the effect of organizational slack remained insignificant.

Table 4. Regression results of the level of innovation.

	Model I		Model II		Model III	
	Stand. coefficients	SE	Stand. coefficients	SE	Stand. coefficients	SE
Firm size	-0.120	0.005	-0.143*	0.005	-0.184***	0.004
Organizational slack	-0.005	0.003	0.017	0.003	0.021	0.003
State ownership	-0.108***	0.023	-0.07***	0.012	-0.040**	0.010
Industry	0.314***	0.010	0.297***	0.023	0.234***	0.022
Internationalization			0.219***	0.042		
Home country institutions					0.357***	0.009
R ²	0.153		0.198		0.268	
R ² -adjusted	0.145		0.189		0.259	

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Further analyses

We performed various tests to confirm the robustness of the results. Above all, we tested the second hypothesis using an alternative measure of home country institutional development, the home country innovation profile, in line with previous studies (e.g. Berry, Guillén & Zhou, 2010). The data is taken from the Global Competitiveness Index of the World Economic Forum. We used the composite measure of the 12th pillar referring to the countries' innovative competitiveness. The results obtained with this alternative measure are consistent with the main findings of this study, indicating that the level of institutional development of a firm's home country positively affects its level of innovativeness.

V. DISCUSSION AND CONCLUSION

Although there is vast research on the effects of internationalization and home country institutions on firms' level of innovation, the majority of studies have examined only one of these factors separately. So, in response to the call of prior literature for considering both firm-specific and location-specific factors (Hitt et al. 2006), we have included both of these variables in this paper. Our study provided a theoretical framework, based on organizational learning, by explaining why and how internationalization is likely to influence the level of innovation of a firm. These results support prior research that has found internationalization to help firms increase their sales and distribute costs between the home and foreign markets, thereby incentivizing firms to innovate in the hopes of gaining profit (Hitt et al., 1997). Firms that engage in international activities gain access to information in the foreign market and can use this new knowledge to facilitate innovation. This process of learning by exporting (Salomon & Shaver, 2005) might expose exporting firms to both technological and market information. This information can flow to the exporting firm from customers or through exporting agents or other intermediaries.

Furthermore, building on institutional theory, our paper suggests that countries have differing levels of competitive advantage and that this advantage can lead to firm-specific advantages for those firms that compete in the international arena (Porter, 1990; Rugman & Verbeke, 1993). Our paper provides empirical evidence on how such country-specific advantages are often driven by effective governments, that is, stronger home country institutional development allows firms to increase their level of innovation. Firms from institutionally more developed countries were found to exhibit higher ratios of R&D investment.

Additionally, we found some interesting results on the control variables in this paper. Firm size and state ownership were found to be negatively correlated with the level of innovation, indicating that larger firms and those owned by the state invest less in R&D than their smaller, privately owned counterparts. In this study, we focused on the context of pharmaceutical and biotechnology industries. In line with our

expectations, firms from the biotechnology sub-industry were found to be more R&D-intensive than pharmaceutical firms.

Overall, our findings have some important implications for researchers and practitioners. Our work contributes to the existing literature by analyzing both the firms' degree of internationalization and their home countries' institutional development as positive reinforcers of the firms' innovation. We join Xie & Li (2018) in encouraging the use of both macro and micro-level factors in the study of learning through exporting. Prior research has established internationalization and home country institutions as drivers of firms' innovation but few studies have included both of them. While Xie & Li (2018) look at subnational institutional development and institutional distance as determinants of learning by exporting, we examine the effects of home country institutional development. By including both country-specific and firm-specific factors, we offer a novel approach to the study of firms' innovation. To the best of our knowledge, we are the first to study internationalization and home country institutions as explanatory variables of the innovations of firms from both developed and less developed countries.

Moreover, we show that the findings of prior research on the determinants of firm-level innovation hold true for our sample of pharmaceutical and biotechnology firms. These sub-industries are characterized by their high R&D intensity and globalization, which makes them interesting study subjects. We respond to requests of recent research for a focus on R&D-intensive industries in the study of innovation (e.g. Chittoor et al. 2015). Firms in these sub-industries are known for their wide-spanning operations in emerging markets. Furthermore, the pharmaceutical sector is growing at a much faster pace in emerging markets, such as China and India, than in developed markets (Rezaie, McGahan, Frew, Daar & Singer, 2012). It is therefore of interest to test whether the growing number of firms from emerging markets matches the R&D investments of their developed country rivals. After all, staying innovative is vital to achieving and maintaining a competitive advantage both in the domestic as well as the global arena (Porter, 1990).

For practitioners, this study shows that managers of purely domestic firms could consider initiating exporting activities in order to acquire new knowledge from the

foreign markets and improve their products and processes based on such information. This could place the firm above its rivals not only in its home market but also in foreign markets, especially in those locations where competitors are from less institutionally developed nations. Furthermore, in addition to pro-innovation policies, governments could promote international trade, which in turn could increase the innovation and productivity of firms that choose to start exporting.

Despite its contributions, this study has several limitations. Firstly, due to the cross-sectional nature of our study, we could not lag the involved variables. Future research could test our hypotheses using panel data over a longer period of time, to account for differences in the levels of internationalization, innovation and the development of home country institutions over time. The use of panel data could also help in confirming the causality. Although our results point to a positive relationship leading from internationalization to innovation, the reverse is also possible. Secondly, the average firm size in our sample is large, thus our conclusions should be carefully extrapolated to small and medium-sized firms (SMEs). Due to limitations in the availability of data, (i.e. as our sample consists of large firms that publish their financial information), it was not possible to include smaller firms. It could be interesting to re-estimate the results with a sample including SMEs. Thirdly, due to limited availability of data, we could not distinguish between international sales made through exports and other entry modes, such as foreign subsidiaries or joint ventures. Future studies could examine whether the choice of entry mode affects the firms' level of innovation.

To continue with our line of work, researchers could consider constructing a model in which they test potential moderating effects of home country institutional development on the relationship between internationalization and innovation. As we have established a positive link between both internationalization and innovation as well as home country institutional development and innovation, it could be further analyzed if the level of institutional development in the firm's home country shapes the strength of the internationalization-innovation relationship.

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APPENDICES

Appendix A. Article overviews

Appendix B. Sampled firms by country

APPENDIX A. ARTICLE OVERVIEWS (1/11)

Article Xie, Z., & Li, J. (2018). Exporting and innovating among emerging market firms: The moderating role of institutional development. <i>Journal of International Business Studies</i> , 49(2), 222-245.			
JCR Impact Factor (2017) 6.198	JCR Impact Factor (2018) n/a	Ranking (2017) Business: 9th Management: 6th	Number of citations -
Research objectives: The study empirically tests how the institutional development of a firm's home region and the institutional distance between the home and target markets affects how the firm benefits from learning by exporting. The sample consists of Chinese manufacturing firms from different regions.			
Measurement of main dependent variables: Innovation was measured as the logarithm of new product output.			
Main findings: The institutional development of the home region and the institutional distance between the home and foreign market were both found to influence the learning firms received through exporting. Specifically, market openness was found to weaken the relationship between exporting and innovation while R&D supporting institutions and development of market intermediaries were found to positively moderate the relationship.			
Rejected hypotheses: All hypotheses were supported.			
Opinion: Xie & Li's work - although empirical - provides an excellent theoretical overview on the relationship between exporting, innovation and institutional development. With 153 articles and books cited in their work, the authors have dug deep and gone the extra mile in literature review. The article displays in-depthness also in its methodology: the final sample included 78,790 firm-year observations. As of the date of writing this thesis, the 2018 article had not received any citations. However, I believe this article will be cited extensively in future research and will generate further studies on the topic.			

APPENDIX A. ARTICLE OVERVIEWS (2/11)

Article Salomon, R. M., & Shaver, J. M. (2005). Learning by exporting: new insights from examining firm innovation. <i>Journal of Economics & Management Strategy</i> , 14(2), 431-460.			
JCR Impact Factor (2017) 1.163	JCR Impact Factor (2005) 0.840	Ranking (2005) Economics: 56 th Management: 36th	Number of citations 556
Research objectives: By examining a sample of Spanish manufacturing firms over a period of 8 years, the authors assess if and how exporting activities – through the diverse information accessed by the firms and brought back home – can increase innovation.			
Measurement of main dependent variables: The first dependent variable ‘product innovation counts’ is measured as the number of new or modified products in a year. The second dependent variable ‘patent application counts’ is measured as the number of Spanish patent applications in a year.			
Main findings: The authors found empirical support for learning by exporting. They conclude that as international firms gain access to diverse knowledge in their export markets that they could not access at home, they can learn from such knowledge and become more innovative in comparison with purely domestic firms.			
Rejected hypotheses: All hypotheses were supported.			
Opinion: The article is well written and it is unarguably a seminal work in the study of learning by exporting. The data source of Spanish manufacturing firms seems to be very comprehensive as various other studies have used it to test their hypotheses (e.g. Cassiman & Golovko, 2011; Golovko & Valentini, 2011). Although this paper provides empirical evidence for the existence of learning by exporting, the findings are limited to Spanish firms. However, this is not stated in the limitations of the study, which could mean that the authors believe their findings can be extrapolated to other countries. In my opinion, it would have been appropriate to mention this in the conclusions or limitations.			

APPENDIX A. ARTICLE OVERVIEWS (3/11)

Article Kafouros, M. I., Buckley, P. J., Sharp, J. A., & Wang, C. (2008). The role of internationalization in explaining innovation performance. <i>Technovation</i> , 28(1-2), 63-74.			
JCR Impact Factor (2017) 4.802	JCR Impact Factor (2008) 1.907	Ranking (2008) Management: 28th	Number of citations 450
Research objectives: This study examines whether the degree of internationalization of a firm positively moderates the relationship between innovation and performance by looking at firms in the UK manufacturing industry over a period of 13 years.			
Measurement of main dependent variables: The dependent variable 'performance' was measured as sales revenue per employee. The independent variable 'innovation' was measured as the ratio of R&D expenses to total revenue.			
Main findings: Internationalization was found to moderate the relationship between innovation and performance. In a subgroup analysis (firms with low versus high level of internationalization), the results for the lower group were insignificant. The authors conclude that these results show that in order to reap rewards from innovation firms must have a sufficiently high level of international operations.			
Rejected hypotheses: All hypotheses were supported.			
Opinion: I think the article offers a comprehensive review of the literature, providing various good justifications for the positive relationship between internationalization and innovation performance but also discussing prior findings of a negative relationship. I find it interesting how the authors conclude that these mixed findings result from the notion that firms benefit from innovation only when they are international enough, thereby adding new, important evidence to existing literature. The discussion section is extensive, with various limitations and lines for future research.			

APPENDIX A. ARTICLE OVERVIEWS (4/11)

Article Wu, J., Wang, C., Hong, J., Piperopoulos, P., & Zhuo, S. (2016). Internationalization and innovation performance of emerging market enterprises: The role of host-country institutional development. <i>Journal of World Business</i> , 51(2), 251-263.			
JCR Impact Factor (2017) 3.993	JCR Impact Factor (2016) 3.758	Ranking (2016) Business: 22nd	Number of citations 37
Research objectives: Using a sample of Chinese manufacturing firms, the study explores how host country institutional development affects the innovation performance of emerging market multinational firms.			
Measurement of main dependent variables: Parent firm innovation performance was measured as the number of patents granted to a firm in each year.			
Main findings: Firms were found to increase their innovation performance when they were exposed to countries with higher institutional development. Moreover, those firms with stronger absorptive capacity were found to benefit more than their less absorptive compatriots. The best innovation performance results were found amongst firms that internationalized in geographically diverse locations with high institutional development.			
Rejected hypotheses: No evidence was found for the last hypothesis, predicting that the positive relationship between host country institutional development and innovation performance would be higher when the parent firm has a joint venture subsidiary, as opposed to a fully-owned subsidiary.			
Opinion: Although the study examines host country institutional development as opposed to that of the home country, it provides interesting findings on how it reinforces the firms' innovation. One especially interesting finding is that state ownership can improve innovation performance for those firms that internationalize in countries with less developed institutions. I think the data collection methods used in the study deserve recognition – the authors have gone through hundreds of annual reports to gather information on the firms' subsidiaries. This is a good example of the use of alternative, more laborious and less readily available data sources to bring new insights.			

APPENDIX A. ARTICLE OVERVIEWS (5/11)

Article Hitt, M. A., Hoskisson, R. E., & Kim, H. (1997). International diversification: Effects on innovation and firm performance in product-diversified firms. <i>Academy of Management Journal</i> , 40(4), 767-798.			
JCR Impact Factor (2017) 6.700	JCR Impact Factor (1997) 2.526	Ranking (1997) Business: 4th Management: 3rd	Number of citations 3,186
Research objectives: The authors build on theories from the disciplines of strategic management, international management and international business to examine the relationships between international diversification, product diversification and innovation and performance. The sample consists of manufacturing firms over a 3-year period.			
Measurement of main dependent variables: Performance is measured using return on assets (ROA) and innovation using R&D intensity (R&D expense over sales).			
Main findings: The authors found a curvilinear relationship between internationalization and performance, in which the complexity and costs of internationalization eventually exceed the benefits at higher levels of international operations. Internationalization was found to be positively correlated with innovation and this relationship was negatively moderated by product diversification. The article suggests this negative moderation might be due to manager incentive structures – as bonuses often depend on profitability and R&D is more of a long-term investment, managers are less incentivized to spend money on R&D.			
Rejected hypotheses: All hypotheses were supported.			
Opinion: In my view this seminal article provides a very good overview of how internationalization affects firm performance and innovation. I find it interesting how the authors discuss and assess existing measures for international diversification and when they are not fully satisfied with any of them, they develop their own entropy measure. All in all, I think the article has good arguments and is well written. I especially like the results section because it is well structured and easy to follow.			

APPENDIX A. ARTICLE OVERVIEWS (6/11)

Article Marano, V., Arregle, J. L., Hitt, M. A., Spadafora, E., & van Essen, M. (2016). Home country institutions and the internationalization-performance relationship: A meta-analytic review. <i>Journal of Management</i> , 42(5), 1075-1110.			
JCR Impact Factor (2017) 8.080	JCR Impact Factor (2016) 7.733	Ranking (2016) Business: 2nd Management: 3rd	Number of citations 45
Research objectives: By combining 359 studies into one multi-country study in their meta-analytic review, the authors aim to integrate research on the relationship between internationalization and performance and explain their mixed results with their lack of consideration for home country institutions as a moderator.			
Measurement of main dependent variables: Does not apply.			
Main findings: Extant research on the relationship between internationalization and performance has often neglected the moderating effect of home country formal and informal institutions, which has led to inconsistent results suggesting positive, negative and nonlinear relationships. The authors conclude that there is a positive linear relationship between the variables although its strength depends on the firm's country of origin.			
Rejected hypotheses: Does not apply.			
Opinion: In my opinion, this is a very exhaustive meta-analysis combining the findings of hundreds of primary studies. However, I would have liked to see a summary table or graph of these articles, something similar to those in Hitt et al.'s (2006: 836-845) literature review. This would help the reader gain a better understanding of what is tested in the 359 studies used in the analysis. In my opinion, the article provides a good overview of how the country of origin affects the relationship between internationalization and firm performance. More specifically, I liked the extensive discussion of the formal and informal institutions and how these might affect the relationship.			

APPENDIX A. ARTICLE OVERVIEWS (7/11)

Article Wan, W. P., & Hoskisson, R. E. (2003). Home country environments, corporate diversification strategies, and firm performance. <i>Academy of Management Journal</i> , 46(1), 27-45.			
JCR Impact Factor (2017) 6.700	JCR Impact Factor (2003) 3.343	Ranking (2003) Business: 2nd Management: 2nd	Number of citations 664
Research objectives: The study examines how home country institutions and factors influence the relationship between strategies of corporate diversification and performance. The sample consists of firms from Western European countries.			
Measurement of main dependent variables: Performance was measured using both ROA and earnings before interest and taxes divided by assets.			
Main findings: Alternative corporate diversification strategies were found to have different effects on performance of firms depending on their home countries' munificence. Firms from more munificent countries were found to benefit from internationalization, while firms from less munificent economies reap rewards from product diversification.			
Rejected hypotheses: In less munificent home country environments outbound international diversification was not found to negatively impact firm performance nor was inbound international diversification found to positively affect performance.			
Opinion: I find the hypotheses of the study very interesting as they propose various relationships between product diversification, international diversification and firm performance depending on the level of development in the home country of the firm. Although the article does not predict innovation performance, I believe low product diversification can be interpreted as high specialization and increased innovation. As such, I find it interesting that in the more munificent environments international firms focused on a few products perform better than highly product-diversified firms.			

APPENDIX A. ARTICLE OVERVIEWS (8/11)

Article Wu, J. (2013). Diverse institutional environments and product innovation of emerging market firms. <i>Management International Review</i> , 53(1), 39-59.			
JCR Impact Factor (2017) 2.279	JCR Impact Factor (2013) 0.929	Ranking (2013) Management: 107th	Number of citations 33
Research objectives: The study examines how institutional distance and diversity between the home country of a firm and the countries in which it has operations affects the firm's product innovation performance. The authors use a sample of Chinese firms in various industries over three years.			
Measurement of main dependent variables: The dependent variable 'product innovation' was measured using the number of new products introduced by a firm to the market over a two-year period.			
Main findings: The study found a positive relationship between institutional distance (between home and foreign operations country) and the introduction of new products. Furthermore, institutional diversity, i.e. the extent to which a firm is exposed to various institutional environments, was found to have a curvilinear relationship with innovation performance.			
Rejected hypotheses: All hypotheses were supported.			
Opinion: I think the study provides interesting implications for both researchers and firms in suggesting that in order to succeed at innovation it is important to be exposed to institutional environments that are highly distant and sufficiently diverse. In my opinion, all relevant limitations (e.g. causality problem, sample of a single country) are discussed in the study. I find it interesting that the author suggests future research on the differences in competitive advantage between firms from emerging and developed countries. We have studied such country-specific advantages in this paper. One interesting fact about this article is that instead of relying on readily available data on large firms, the author approached small and medium-sized firms with a survey. This allowed him to tailor the data to his needs. However, I would have liked to have a look at the survey questions but these were not disclosed in the article.			

APPENDIX A. ARTICLE OVERVIEWS (9/11)

Article Porter, M. E. (1990). The competitive advantage of nations. <i>Harvard Business Review</i> , 68(2), 73-93.			
JCR Impact Factor (2017) 4.374	JCR Impact Factor (1990) n/a	Ranking (1990) n/a	Number of citations n/a
Research objectives: With a sample of 10 countries, the author aims to identify and describe the determinants that make one nation more competitive in a certain industry than another. Looking at competitive data over decades the study intends to shed light on how the existence of such determinants affects firm strategy and national economies.			
Measurement of main dependent variables: National competitiveness is proxied by the level of productivity and productivity growth.			
Main findings: The competitiveness of a country was found to be determined by four elements: the nation's available factors, national demand, the existence of competitive supplier or related industries, and firm strategy, structure and rivalry amongst firms. In this diamond model the nation's competitiveness is essentially driven by its ability to innovate.			
Rejected hypotheses: Does not apply.			
Opinion: This article, which is essentially a summary of the findings of the book by the same name, is written in a way that everyone can understand. I think it establishes well the importance of the findings and provides good examples. I am not surprised that the diamond model developed by Porter is still widely used among scholars and practitioners. I think it is reasonable to say that anyone studying international business should come across this model during their studies. I believe that in its simplicity, the model provides a very good overview of the differing levels of competitive success between countries. However, much has happened in 28 years after the publication of the article and I think some aspects deserve an update to this century (in a way similar to what Johanson & Vahlne did with their theory on internationalization).			

APPENDIX A. ARTICLE OVERVIEWS (10/11)

Article Filippetti, A., Frenz, M., & Ietto-Gillies, G. (2017). The impact of internationalization on innovation at countries' level: the role of absorptive capacity. <i>Cambridge Journal of Economics</i> , 41(2), 413-439.			
JCR Impact Factor (2017) 2.070	JCR Impact Factor (2017) 2.070	Ranking (2017) Economics: 77th	Number of citations 13
Research objectives: This macro-level study tests how internationalization influences the innovation performance of countries and how the absorptive capacity of countries affects the relationship between internationalization and innovation. The sample consists of 40 countries, including both emerging and developed economies.			
Measurement of main dependent variables: Innovation was measured using annual growth in total factor productivity and the number of triadic patent applications per million people.			
Main findings: Outward foreign direct investment (FDI) was found to be positively and non-linearly related to innovation, with countries of a moderate degree of absorptive capacity benefiting the most. Countries with high absorptive capacity were found to benefit from inward FDI. Low absorptive capacity countries were found to benefit from importing and exporting. The authors found no support for learning by exporting for countries with a high absorptive capacity.			
Rejected hypotheses: All hypotheses were supported.			
Opinion: The research question of the study is interesting and related to our topic. However, as the authors themselves acknowledge, there is room for improvement. It seems the study was published in a hurry, as there are various limitations that could have been addressed. This creates an unfinished feeling and my overall impression of the article is not very high. I also find it distracting that the hypotheses are not stated clearly. Reading through the text carefully it is possible to distinguish them but they are not numbered and are hidden in the body text. The lack of numbered hypotheses also makes it more difficult to interpret the results.			

APPENDIX A. ARTICLE OVERVIEWS (11/11)

Article Chittoor, R., Aulakh, P. S., & Ray, S. (2015). Accumulative and assimilative learning, institutional infrastructure, and innovation orientation of developing economy firms. <i>Global Strategy Journal</i> , 5(2), 133-153.			
JCR Impact Factor (2017) 2.121	JCR Impact Factor (2015) 1.206	Ranking (2015) Management: 104th	Number of citations 17
Research objectives: The study examines how firms learn from international markets and how such learning influences their innovation efforts. With a sample of 11,048 Indian firms over a 20-year period, the authors explore how the institutional development of the home country affects the internationalization-innovation relationship.			
Measurement of main dependent variables: The dependent variable 'investments in innovation' was measured using total R&D expense over total sales.			
Main findings: Both participation in the international markets and technology imports were found to drive firms' level of innovation investments. The institutional environment was found to moderate these relationships in that when the institutions are less developed, technology imports drive firms' innovation efforts, while in the case of more developed institutional environment it is internationalization that boosts firm-level innovation.			
Rejected hypotheses: All hypotheses were supported.			
Opinion: I find it interesting how the authors chose to study the effects of institutional development within a single country, during two decades. Although the use of one country might entail some inherent limitations in terms of generalizability, I think it allows for a more in-depth study and is free of some problems that multi-country studies might present (e.g. cultural differences, local wars and economic downturns). I believe the data used in this study has a lot of potential as it spans an era of economic development in India and includes almost all firms within the manufacturing industry. It could be used to study the influences of institutional development on other variables as well. One interesting notion is that the authors acknowledge that their data includes firms that are not innovative, and suggest future studies to test the relationship on R&D-intensive industries, which is what we have done in this study.			

APPENDIX B. SAMPLED FIRMS BY COUNTRY

Region of Headquarters			GICS Industry Name		Total
			Biotechnology	Pharmaceuticals	
Africa	Country of Headquarters	South Africa	0	1	1
	Total		0	1	1
Americas	Country of Headquarters	Argentina	1	0	1
		Canada	2	7	9
		United States	20	15	34
	Total		23	22	44
Asia	Country of Headquarters	China	37	158	195
		Hong Kong	2	6	8
		India	1	24	25
		Indonesia	0	3	3
		Israel	1	1	2
		Japan	5	20	25
		Jordan	0	2	2
		Korea, Republic	9	16	25
		Singapore	0	1	1
		Taiwan	8	22	30
		Thailand	0	1	1
	Total		63	254	317
Europe	Country of Headquarters	Austria	0	1	1
		Belgium	1	2	3
		Denmark	3	3	6
		Finland	0	1	1
		France	1	2	3
		Germany	3	3	6
		Hungary	0	1	1
		Ireland	2	5	7
		Luxembourg	1	0	1
		Netherlands	1	0	1
		Poland	1	0	1
		Russia	0	1	1
		Slovenia	0	1	1
		Spain	2	2	4
		Sweden	7	3	10
		Switzerland	2	3	5
		United Kingdom	3	12	15
	Total		27	40	67
Oceania	Country of Headquarters	Australia	6	4	10
		New Zealand	0	1	1
	Total		6	5	11
Total			119	322	441