Factors that Influence the Perceptions of the Obstacles to Innovation in the Context of a Developing Country, Case of Ecuador

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Abstract. Currently, innovation has become a key factor for the development of a country and for each of the companies that comprise it, and it is essential to mention the individual development of the human beings themselves, who constantly seek to generate changes and adapt to the current context as a requirement of globalization. Nowadays, we can find a large number of goods and services that adapt to our needs in any part of the world without having to move from our home; and despite being a great advantage, this situation is a direct threat to business competitiveness. (Madero and Barboza 2015). This research aims to analyze the factors that influence the perception of obstacles to innovation, why some companies perceive more, or fewer obstacles and which sectors of economic activity have more difficulties in innovating.

The research findings reveal the main characteristics that influence the perception of obstacles to innovation as it is; age of the company, business cooperation, size and sector to which the industry belongs.

Keywords: Innovation · Developing · Companies · Probit · Ecuador · Obstacles

1 Introduction

According to the neo-Shumpeterian theory, the analysis of innovation is considered a variable of vital importance at the business level; if a study is carried out over time, it can be considered that, in the 1980s, there was no emphasis on this aspect; but in market and economic efficiency, while, in the neoclassical analysis, the decisions made by companies to invest in research and development are prioritized, taking into account their individual capacities and how these will allow the generation of new products or services for society (Fernández 2015).

Now, companies face great challenges, one of the greatest is the existing competition, according to Armijos, the competition will no longer be really defined according to the size of the company, but according to the speed with which these respond to the business macro environment and adapt to seize opportunities and mitigate threats, but this process will only be possible if it goes hand in hand with adequate public policies that encourage

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and allow adequate development for the benefit of society and the defense of equity (Guaipatin and Schwartz 2014).

Despite being a broad and necessary subject of study due to the great economic and development benefits that business innovation implies, there is very little research that analyzes the barriers that hinder business innovation and the existing variations according to size and the limitations that companies face in order to implement an efficient development that generates broad benefits (Hölzl and Janger 2011). Enterprises that excel in innovation face a pressing need to overcome barriers that limit their growth and expansion; among these we can mention the cultural barriers that limit the development of goods or services to be able to cover a specific market segment that demands according to their desires and needs. (Zhao 2006).

This research aims to analyze the business, sectoral and regional factors that influence the perception of barriers to innovation broken down into cost, knowledge and market factors, in the context of a developing country such as Ecuador; In order to evaluate the hypothesis, it can be stated that there are empirical studies that have been developed in countries such as France and Italy that choose some factors mentioned in this study, and this examination is based on the studies by Madeira et al. (2017), Castro et al. (2017) and Hölzl and Janger (2011).

The document is structured as follows: Sect. 2 summarizes the literature on obstacles to innovation, Sect. 2.3 studies the factors that affect the perception of barriers to innovation, Sect. 3 details the data source and models used for econometric estimation, Sect. 4 analyzes the results of the econometric tests and finally Sect. 5 indicates the general conclusions found in the study.

2 Review of the Literature on Barriers to Innovation

2.1 External and Internal Barriers to Innovation

Innovation is crucial to determine business growth and competitiveness (Mohnen and Rosa 2002); The level of innovation varies from one company to another and is determined by several complex factors, which can facilitate and motivate the start of innovation, or generate barriers (D'Este et al. 2012). These barriers can be classified as external when companies acquire external resources or knowledge (Hadjimanolis 1999), according to Hölzl and Janger (2011) these barriers arise when the company interacts with other companies, agents or institutions in the innovation procedure. The internal barriers, associated with difficulties in implementing internal changes in their organizational processes, according to Saatçioglu and Ozmen (2010) and (Hadjimanolis 1999) the main ones are: lack of qualified personnel, lack of R&D, difficulty in controlling the costs of innovation and financing innovation. D'Este et al. (2012) includes lack of funds, high costs of innovation, lack of information about markets, and effective interactions between innovation cooperation partners.

Innovative companies need to face these obstacles, to a greater or lesser degree depending on their environment; however, there are companies that discourage participation in innovation due to certain barriers involved, for this reason it is important to distinguish the different types of innovation barriers for policy formulation and timely action by management, according to Baldwin and Ozmen (2002) the perception of the

importance of such barriers show that the greater the participation of the company in R&D and other innovation activities, the greater the importance attributed to impediments to innovation. Certain barriers are not effectively perceived until the companies face them and depending on the degree of innovation, the problem will increase (Galia and Legros 2004).

According to the National Survey of Innovation Activities (NSIA) 2015, the barriers to innovation are grouped into 3 types of factors (Factor costs, knowledge and market), detailed in Table 2. Galia and Legros (2004), explore the factors that explain the perception of obstacles to innovation faced by French manufacturing companies, distinguishing between obstacles to innovation in proposed projects and obstacles in abandoned projects. According to Iammarino et al. (2009), the perception of obstacles to innovation plays a key role in shaping the characteristics of the local technological environment; the factors they analyze are: type of company, location of the company and sectors of economic activity.

2.2 Factors that Hinder Innovation Activities

According to the NSIA (2015), within the cost factors, the following variables are considered: the lack of funds within the company, lack of external financing and the high costs of innovation, the high costs of innovation, research and development activities are considered to be the most important barriers to implement innovation in the company, preventing SMEs from financing activities related to innovation (Larsen and Lewis 2007). Public support through credits has contributed to the increase of R&D in investing companies and others that wish to do so as well; having different sources of financing can exert positive effects on innovation behavior.

In the Knowledge Factor, the following variables are considered: lack of qualified personnel in the company, lack of qualified personnel in the country, lack of information on technology, lack of information on markets, and difficulty in finding cooperation partners. The lack of qualified personnel is related to the condition of the employee when adopting innovation in the company due to the aversion to change (Rora and Nabila 2020), generating internal resistance and endangering the competitiveness of a company. According to Zwick (2002), a high level of employee resistance can be caused by the perceived risk of job loss after the changes generated, which can be mitigated by providing guarantees or compensation to employees. The lack of information on technology and the market is a barrier to the development of innovative corporate processes, the pressure that demanding and sophisticated clients currently exert on companies encourage them to compete and innovate (Amara et al. 2016); however, companies must know their market and adapt to its current demands (Madeira et al. 2017). Establishing contact with internal or external partners has an important influence on the innovative capacity of companies to generate greater probabilities of introducing new products in the market (Fukugawa 2006). Innovation cooperation with other companies can improve shock absorption capacity and benefit from additional resources for R&D; but the difficulty to find cooperative partners for innovation is a major barrier; however, there are companies that successfully innovate without resorting to cooperation partners, which shows that innovation strategies based on their capabilities are more significant (Freel and Harrison 2011).

Finally, the market factor according to NSIA (2015) considers as elements: the dominant markets for established companies and the uncertainty for the demand for goods and services. The links between innovation and market dominance are more complex and multifaceted than cross-sectional studies typically convey (Cohen 2010) and economists have put forward a number of theoretical arguments giving different and contradictory results about the effects of market structure on the innovation; Some economists support Schumpeter who mentions that companies in concentrated markets have a stronger incentive to invest in innovation because they seek to prevent other competitors from entering. Porter (1980) mentions that the active pressure of rivals stimulates innovation due to the fear of being left behind and the incentive to capture a greater market share.

2.3 Factors that Affect the Perception of Obstacles to Innovation

Firm-level characteristics play a crucial role in shaping innovation activity across technology areas and industries (Archibugi et al. 2013). In this study, the following characteristics are considered: size of the company, regional factors, sectors of economic activity, export status, how old the company is, state of internationalization of the firms, business cooperation and type of innovative company. Regarding the size of the company, according to Hadjimanolis (1999), small and medium-sized companies, even in industrialized countries, face more barriers to innovation than large ones due to the lack of internal resources, experience, technological infrastructure and inadequate policy; SMEs in particular tend to use networking to overcome these barriers; The Schumpeterian hypothesis establishes that large companies are in a better position to be innovative by taking advantage of market imperfections and can distribute the costs of innovation in the production units (Castro et al. 2017).

In relation to regional factors, location plays an important role. The grouping of certain regions can help companies improve their specific advantages as mentioned by Suarez and Rama. The support in carrying out subcontracting processes, and the specialization of certain regions allows companies to save resources that can later be channeled into R&D. Depending on the sectors of economic activity, according to the OECD (2018), companies are classified as follows: depending on their activity; depending on the sectors of high, medium, or low technological intensity, the capacity for innovation does not depend only on the company per se, but also depends on the characteristics of the sector in which it operates; market needs and other external factors. For Madeira et al (2017), industrial companies perceive cost obstacles and lack of financing to a greater degree and, according to Segarra et al. (2017), manufacturing companies tend to be more sensitive to access to financing.

Regarding export status, according to Hölzl and Janger (2011), exporting firms perceive higher barriers to innovation than non-exporting firms, indicating that international markets face severer innovation competition. Latin American exporters are less likely to abandon R&D projects during a crisis (Castro, and others 2017). In relation to the age of the companies, younger companies tend to seek new investment opportunities and innovations, and challenging existing corporations (Archibugi et al. 2013). However, these companies tend to perceive more financial barriers (Segarra et al. 2017).

Regarding the state of internationalization of firms, for Iammarino et al. (2009), multinational companies have high levels of accumulated competition, which makes them more intensive in research. Being part of a multinational group reduces the perception of barriers associated with the lack of technological and market knowledge (Hölzl and Janger 2011), while companies that are part of a business group (national or foreign) perceive lower barriers to innovation related to costs, financing, and market (Fuentes et al. 2018). The Schumpeterian approach emphasizes the bidirectional relationship between multinational expansion and innovation. Business cooperation to innovate with other companies and with institutions allows them to benefit from additional resources that can be allocated to R&D (Castro et al. 2017); Ahuja (2000) mentions that cooperation activities with other companies are opportunities to access complementary technological resources that can contribute to the faster development of innovations, better access to the market, economies of scale and scope, shared costs, and distribution of risks.

3 Methodology

3.1 Design and Sample

This research uses data from the National Survey of Innovation Activities for the period 2012–2014 (NSIA), which contains information on 6,275 companies in Ecuador. Of these companies, 43.26% have perceived obstacles to innovation linked to factors: costs, knowledge and/or market. These factors are classified into 10 variables; companies value these variables as an obstacle according to their importance on a scale of high, medium, low, and not experienced. From this scale, a dichotomous variable is constructed for each obstacle based on the work of Holzl and Jünger (2011), the variable takes the value of one if the company considers the importance of the obstacle as high or medium and the value of zero for low or non-experienced.

3.2 Procedure

To analyze the problem, dichotomous variables were created for each obstacle to innovation activities and the model was run with the independent variables of interest that hinder innovation activities included in the factors: company characteristics (company size, age of the company, nationality, business cooperation, exporting companies, types of innovative companies), sectors of economic activity (Extended Classification of Economic Activities "ISIC") and region (provinces of Ecuador).

In the methodology applied in the study, probit models were used. Each of the factors that are perceived as obstacles to innovation constitute the dependent variables and the independent ones are expressed in the following variables: characteristics of the company, sectors of economic activity and region (provinces), the model expressed as follows:

Barriers = (Company Size, age, Domestic Company, Foreign Company, Export, Cooperate, Innovator, Sector, act, econ, Regions (Provinces)).

4 Results

In the Ecuadorian context, a descriptive review of relevant data is carried out regarding the barriers to innovation according to ENAI (2015), in relation to the importance of the factors to innovation, the following factors are (Table 1):

Table 1. Obstacles to innovation

	FACTOR	High	Medium	Low	n/a.
Costs	Lack of funds	20,85%	24,49%	13,41%	41,25%
	Lack of financing	16,57%	14,66%	13,24%	55,32%
	High Innovation Costs	29,69%	21,58%	11,71%	37,02%
Knowledge	Lack of qualified personnel	10,79%	24,05%	19,67%	45,49%
	Lack of qualified personnel in the country	8,77%	16,94%	19,48%	54,81%
	Lack of information about technology	11,16%	23,09%	19,48%	46,26%
	Lack of information on the markets	10,09%	21,84%	19,19%	48,88%
	Difficulty finding cooperation partners for innovation	12,27%	12,41%	11,27%	64,05%
Market	Market dominated by companies	18,90%	22,21%	14,14%	44,75%
	Uncertainty in the demand for goods and services	18,01%	24,60%	15,06%	42,32%

n/a (not applicable).

The factor that most hinders innovation activities for Ecuadorian companies is the cost factor, 67.11% consider it high. Within this factor, companies consider the high costs of innovation to be the most important: 29.69%. In the knowledge factor, the difficulty in finding cooperation partners is considered to have a high impact at 12.27%; the lack of qualified personnel, 10.79%; and in the market factor, 18.90% of companies consider that a market dominated by companies has a high impact on innovation.

Subsequent, the probit regression models are applied to the cost, knowledge, and market factors, perceived as obstacles to innovation.

V1 (Lack of funds), V2 (lack of financing), V3 (high costs), V4 (lack of company qualified personnel), V5 (lack of qualified country personnel), V6 (lack of technological infrastructure), V7 (lack of market infrastructure), V8 (partner cooperation), V9 (market dominating companies), V10 (demand uncertainty). D1 (Small business), D2 (Big company), D3 (company age), D4 (Domestic company), D5 (foreign company), D6 (Business cooperation), D7 (Cooperation institutions), D8 (Cooperation companies institutions), D9 (Exporter), D10 (non-innovative investor), D11 (Non-investor innovator), D12 (Manufacturers_BIT), D13 (Manufacturing_MBIT), D14 (Manufacturers_MAIT), D15 (Manufacturers_AIT), D16 (Knowledge intensive service), D17 (Service provider), D18 (extractive sector), D19 (Building), D20 (Azuay), D21 (Bolívar), D22 (Cañar), D23 (Carchi), D24 (Cotopaxi), D25 (Chimborazo), D26 (Oro), D27 (Esmeraldas), D28

Table 2. Results of applied models for cost, knowledge, and market factors

	Independent variables									
	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
D1	.12287531	.15333061	.20662065*	−.12691057	−.10427345	−.07558789	.05988586	.02582412	.09085677	.15333061
	(.0906857)	(.0933642)	(.0916537)	(.0899952)	(.095892)	(.0916202)	(.0948091)	(.0980616)	(.0906485)	(.0933642)
D2	.2317211*	−.1978752*	−.05749256	−.290858**	−.16300259	−.09094563	−.04680036	−.02562516	−.08160101	−.1973752*
	(.0930546)	(.0968171)	(.0934196)	(.0923527)	(.0977497)	(.0936973)	(.0969766)	(.1008053)	(.0923516)	(.0968171)
D3	−.0040316*	−.00390273*	−.00137783	−.00114197	−.00403608*	−.00187299	−.00186878	−.00332353	−.00360176*	−.00390273*
	(.0017792)	(.0019312)	(.0017357)	(.0017611)	(.0018672)	(.0017894)	(.0018408)	(.001902)	(.0018201)	(.0019354)
D4	.221778**	−.2011284*	−.07717348	.02519123	−.03055275	−.09386243	−.02918339	−.09883997	.00962748	−.2019284*
	(.0797564)	(.0852275)	(.078505)	(.0806289)	(.0852221)	(.0806492)	(.0821788)	(.0872312)	(.0792651)	(.0122434)
D5	.50006***	.71786***	−.38979***	−.40875***	−.2725479*	−.325874**	−.311162**	−.20242893	−.309919**	−.71786***
	(.1089694)	(.1325065)	(.102812)	(.1158816)	(.1159288)	(.1129222)	(.1130433)	(.1181554)	(.1057494)	(.1325065)
D6	.18481751*	.11841619	.297668***	.399113***	.298633***	.288856***	.359642***	.2617043**	.432123***	.11841619
	(.072796)	(.0780003)	(.0725039)	(.0769004)	(.0808065)	(.0751435)	(.0778468)	(.081694)	(.0745274)	(.0780003)
D7	.24404224	.17550418	.39681713	.67573203*	.32506651	.61921644*	.4285524	.52433285	.1393279	.17550418
	(.2921058)	(.3213549)	(.2976956)	(.3025611)	(.3371296)	(.3047993)	(.3171242)	(.3287473)	(.3228972)	(.3213549)
D8	.335338***	.364519***	.505501***	−.27269538	.511258***	.416724***	.504236***	.485501***	.635354***	.364519***
	(.0913487)	(.0958295)	(.0921551)	(.3006193)	(.098312)	(.094083)	(.0962451)	(.0995657)	(.0922382)	(.0958295)
D9	−.00818663	.09291478	−.04680595	−.04352649	.11512762	−.14954828	−.09559279	−.15745642	−.15443316	.09291478
	(.081462)	(.0862545)	(.0793148)	(.0827207)	(.084728)	(.0832237)	(.0843545)	(.0886217)	(.0806925)	(.0862545)
D10	−.608858***	−.565595***	−.71266***	−.3810657**	−.27576728*	−.433568***	−.452089***	−.3634809**	−.434141***	−.565599***
	(.1140187)	(.1317485)	(.1132998)	(.1199122)	(.124574)	(.1175054)	(.1241347)	(.1258695)	(.1160146)	(.1317485)

(*continued*)

Table 2. (*continued*)

	Independent variables									
	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
D11	−.22314798	−.2762886	−.416788**	−.610884***	−.31441904*	−.15975491	−.03146175	−.21467467	.00924064	−.2762886
	(.136959)	(.1474952)	(.1338111)	(.1548167)	(.1542894)	(.1407574)	(.1400185)	(.1517399)	(.1374739)	(.1474952)
D12	.2878926***	.3270951***	.282003***	.12961344	.1822046*	.11584953	.03445452	.10994213	.2128201**	.3270391***
	(.0714552)	(.074087)	(.0711481)	(.0719836)	(.0748789)	(.0722114)	(.0727683)	(.0766813)	(.0710251)	(.074087)
D13	.23921577*	.12886157	.12815427	.09506802	.19931194	.12880426	.23642112*	.03962612	.02396297	.12886157
	(.1112252)	(.1170404)	(.1121633)	(.1142955)	(.1183897)	(.1138788)	(.1134251)	(.1223558)	(.1132393)	(.1170404)
D14	.23202619*	.3787378***	.14796245	.09813194	.22184599*	.14665467	−.01429334	.102257	.12594921	.3787368***
	(.1038916)	(.1081585)	(.1036968)	(.1069921)	(.1101971)	(.1083278)	(.1088018)	(.1145089)	(.1050417)	(.1081585)
D15	.02799145	−.06041151	.12086642	.07376599	.25354584	.21923397	−.01226871	.37231016	.02077598	−.06041151
	(.2364396)	(.2433639)	(.2248297)	(.2332815)	(.2271993)	(.2265078)	(.238852)	(.23335)	(.2196858)	(.2433639)
D16	−.0004126	−.08332192	.02127765	−.01491386	−.08144702	−.18044557*	−.1402625	.10856629	.07127011	−.08332192
	(.0728779)	(.0782911)	(.0720703)	(.0744771)	(.078461)	(.0750063)	(.0754367)	(.0770514)	(.0719533)	(.0782911)
D17	−.06004318	.27259353	−.30955678	.01361894	.00668854	−.20170327	−.47295724*	−.10249082	−.48537229*	.27259353
	(.2050238)	(.2174221)	(.2021504)	(.1970032)	(.2116091)	(.2041524)	(.2301827)	(.2266996)	(.2061841)	(.2174221)
D18	.62819025**	.47197321*	.64020398*	.18780047	.3251616	.28639801	.1177653	.44590603	.10298736	.47197321*
	(.2404978)	(.2215671)	(.262888)	(.2310642)	(.2319605)	(.2342761)	(.2420753)	(.2323869)	(.2362897)	(.2215671)
D19	.02156517	.15311548	−.10300705	−.07030732	−.07265584	−.022188	−.02396988	.05682796	.10618718	.15311548
	(.1042113)	(.1089222)	(.1057077)	(.1104411)	(.1164888)	(.1079715)	(.1105854)	(.1139043)	(.1043986)	(.1089222)
D20	.15734123	−.0744743	.18938169	.22152125*	.16199669	.2835302**	.18181984	−.18450477	.04303593	−.0744743
	(.1025373)	(.1067089)	(.1023302)	(.1043368)	(.1080091)	(.1032857)	(.1053511)	(.1150679)	(.1029511)	(.1067089)

(*continued*)

Table 2. (*continued*)

	Independent variables									
	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
D21	−.21076223	.31889428	−.37757411	−.10296896	−.40337775	.00076692	−.89417658	−.87861051	−.0657921	.31889428
	(.3994917)	(.4029731)	(.385276)	(.3882322)	(.4387728)	(.386923)	(.533792)	(.5076178)	(.381518)	(.4029731)
D22	.31117613	.05838648	−.02088213	−.3030529	−.50856911	−.18512274	−.38431048	−.92353828	−.78468468*	.05838648
	(.310422)	(.3164583	(.317614)	(.3485055)	(.4127424)	(.3459504)	(.3716143)	(.5117659)	(.3578416)	(.3164583)
D23	−.12706795	−.41716035	−.02921616	.10127788	−.42967307	.34973164	.29814271	−.15346518	.16843677	−.41716035
	(.2634514)	(.2976145)	(.2842613)	(.2687551)	(.3406096)	(.2705381)	(.2720838)	(.2973541)	(.2656258)	(.2976145)
D24	.23699606	.16056455	.31421955*	.43129688**	.29055928*	.5295362***	.26124573	.30681421*	−.05220137	.16056455
	(.1438389)	(.1416722)	(.1462333)	(.1421171)	(.1452614)	(.1430098)	(.1423144)	(.1437392)	(.1403378)	(.1416722)
D25	−.07221612	−.01382934	.04450119	.25840434	.06191975	.46426532**	.10909375	−.10757796	−.06412019	−.01382934
	(.1580478)	(.1610429)	(.160707)	(.1580736)	(.1655394)	(.1582286)	(.1599569)	(.1670084)	(.1575931)	(.1610429)
D26	.175624	.21536881	.4391266**	.2787077	.27484062	.3853988*	−.10439704	−.04986483	−.09404917	.21536881
	(.1643489)	(.1615273)	(.1691726)	(.1647805)	(.1677262)	(.1659121)	(.176425)	(.1742909)	(.1686403)	(.1615273)
D27	.48933601**	.6323248***	.32331083	.35711565*	.08999336	.6611272***	.6304734***	.2224861	.28973414	.6323283***
	(.1855882)	(.1817837)	(.1833557)	(.1779625)	(.1873187)	(.1762714)	(.1765143)	(.18648)	(.1823834)	(.1817837)
D28	−.2969979***	−.405685***	−.26531***	−.20025931*	−.2426236**	−.20226303*	−.2549666**	−.307948***	−.18738803*	−.405685***
	(.0768342)	(.0841796)	(.0755642)	(.0789522)	(.0837721)	(.0797337)	(.0807317)	(.0857522)	(.0758124)	(.0841796)
D29	−.14944019	−.22710954	−.05023331	−.02762813	−.24914457	−.00330128	−.02825758	.0919558	−.03614266	−.22710954
	(.13731839	(.1479751)	(.1377697)	(.1380563)	(.1547812)	(.1397501)	(.1404508)	(.1425913)	(.1352865)	(.1479751)
D30	.61158996**	−.00777589	.42011292*	.14806125	.25459924	.24588077	.0381491	.08421855	−.16524911	−.00777589
	(.2000029)	(.1959218)	(.2061129)	(.1872095)	(.1973961)	(.1948396)	(.1916515)	(.2028004)	(.19736)	(.1959218)

(*continued*)

Table 2. (*continued*)

	Independent variables									
	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
D31	−.47929276*	−.8132994**	−.4773299*	−.34353515	−.51968095	−.55802482*	−.28265117	−.21378854	−.46429305*	−.8132994**
	(.2277018)	(.2731614)	(.2165316)	(.2258193)	(.2658166)	(.2494803)	(.2279769)	(.229668)	(.2185298)	(.2731614)
D32	−.19980652	−.20492607	−.25272795	−.05153808	−.13064955	−.06334543	−.29575064*	−.31247849*	−.32591118*	−.20492607
	(.1366877)	(.1402331)	(.1343277)	(.1387022)	(.1463879)	(.1396041)	(.1456095)	(.1575573)	(.1370967)	(.1402331)
D33	1.1751559*	.77607101	1.3170398*	11.471.055	.17966324	.68088882	.74268471	1.2147059*	−.19003955	.77607101
	(.5960768)	(.5006616)	(.6070459)	(.606791)	(.6293524)	(.594825)	(.5384426)	(.5738513)	(.6261787)	(.5006616)
D34	.44915071	.46906637	.69055422	.88216519*	.85193889*	.19988381	.94885605*	.36647987	−.41859942	.46906637
	(.403244)	(.3844413)	(.4166495)	(.408798)	(.3906312)	(.3823288)	(.3954984)	(.380528)	(.3955581)	(.3844413)
D35	−.05882871	−.64281086	.04341421	.69420548*	−.32609625	.17811718	.54034541	−.09991636	−.92022225*	−.64281086
	(.3441615)	(.4220483)	(.3422199)	(.3492739)	(.4223701)	(.3506048)	(.3388488)	(.3852784)	(.4219107)	(.4220483)
D36	.01430599	−.00499488	−.0286718	.24473364*	.2021078*	.2248269*	.25241263*	.13206933	.03864088	−.00499488
	(.0983045)	(.1011102)	(.0985102)	(.0985098)	(.1014379)	(.0992126)	(.0990193)	(.1015043	(.0981241)	(.1011102)
D37	−.01217716	−.53404239	−.0149112	.79026064	.97538907	.75432712	.81485088	.80898906	.49226133	−.53404239
	(.6526922)	(.7386407)	(.620966)	(.6705892)	(.6649747)	(.6794282)	(.6952747)	(.6720057	(.7051537)	(.7386407)
D38	–	–	–	.22951126	.50419261	–	–	–	.24866782	(omitted)
	(omitted)	(omitted)	(omitted)	(.8623336)	(.8216799)	(omitted)	(omitted)	(omitted)	(.9608468)	(omitted)
D39	.03113574	.02877864	.30406725	.15164544	.06456516	.37539006	−.00091849	.24614696	.25980967	.02877864
	(.219199)	(.22116)	(.2233685)	(.2211813)	(.2310469)	(.2183064)	(.2205433)	(.2244131)	(.2180568)	(.22116)

(*continued*)

Table 2. (*continued*)

	Independent variables									
	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
D40	.02747875	.09685608	.02661109	.44016412*	−.06994417	.43411388*	.47019453*	.08980273	.24054238	.09685608
	(.2157763)	(.217958)	(.2185151)	(.2173873)	(.2304186)	(.2164675)	(.2167999)	(.228902)	(.2189263)	(.217958)
D41	−.07193948	−.11727294	−.07780204	−.35941052*	−.35254405	−.13527766	−.34043045	−.28197362	−.4933155**	−.11727294
	(.1654432)	(.1710073)	(.1657358)	(.1777381)	(.1936184)	(.1697434)	(.1787794)	(.1872376)	(.1777396)	(.1710073)
D42	.27719994	−.08423844	.05950347	.56953875	−.00189487	.10743339	−.03955736	.25350922	−.12136696	−.08423844
	(.2897465)	(.3052225)	(.3199275)	(.2943541)	(.328594)	(.3041812)	(.3034912)	(.2876624)	(.3033318)	(.3052225)
_cons	−.15693557	−.506531***	−.2666163*	−.547005***	−.767519***	−.57399***	−.711697***	−.836057***	−.502309***	−.506532***
	(.1174857)	(.1251914)	(.1176786)	(.1208742)	(.1275714)	(.1200127)	(.1251948)	(.1303417)	(.1173352)	(.1251914)
Ob	2713	2713	2713	2715	2715	2713	2713	2713	2715	2713
R	0.0767	0.0842	0.0693	0,0583	0,045	0.0513	0.0537	0.0430	0.0514	0.0848
log	−1.725,14	−1.541,81	−1.749,41	−1.652,84	−1.477,92	−1.653,33	−1.607,05	−1.449,07	−1.744,16	−1.540,73

* $p < 0.05$; ** $p < 0.01$; *** $p < 0$.

(Guayas), D29 (Imbabura), D30 (Loja), D31 (Ríos), D32 (Manabí), D33 (Morona Santiago), D34 (Napo), D35 (Pastaza), D36 (Tungurahua), D37 (Zamora Chinchipe), D38 (Galapagos), D39 (Sucumbíos), D40 (Orellana), D41 (Santo Domingo de los Tsáchilas), D42 (Santa Elena), Ob (Observations), R (pseudo R2), Log pseudolikelihood (log).

Depending on the size of the companies, large companies perceive fewer obstacles to innovation due to lack of funds, lack of financing, lack of qualified personnel and uncertainty in demand; and small-sized companies mostly perceive the high costs of innovation as an obstacle. The age of the company has a negative influence on the perception of lack of funds, lack of financing, lack of qualified personnel in the country and markets dominated by established companies. Younger companies are more likely to perceive obstacles to innovation compared to companies with more years of experience in the market, older companies have opportunities to access financing, with personnel who have managed to accumulate experience in the market. However, it is the younger companies that are more likely to innovate.

Foreign companies perceive fewer obstacles to innovation. On the other hand, domestic companies tend to perceive less the obstacles related to: lack of funds within the company or group, lack of financing from sources outside the company and uncertainty of the demand for innovative goods and services. Companies that are part of a business group have fewer obstacles. Exporting companies are more likely to perceive obstacles to innovation due to lack of financing from foreign sources, lack of qualified personnel in the country, and uncertainty regarding the demand for innovative goods and services. However, the results in the study are not significant. Future research should extend this study. Regarding cooperation, companies that cooperate with other companies (clients and consumers, competitors, suppliers and consultants) are more affected by: lack of funds, high costs for innovation, knowledge factors, difficulty in finding cooperation partners for innovation and markets dominated by established companies. Although cooperation can create a competitive advantage for companies and institutions by participating in cooperation networks, it works as long as selfish behavior is eliminated and trust between partners is fostered.

Finally, companies that cooperate both with companies and with institutions tend to perceive more strongly all the obstacles to innovation related to: costs, knowledge and market. Since these companies cooperate with all possible partners, they will encounter more obstacles, and the more cooperating partners intervene, the more complex innovation becomes.

Investing non-innovative firms and non-investing innovative firms are less likely to perceive obstacles to innovation than R&D innovating firms. By not developing their own R&D, these companies do not experience the high costs that these activities generate. Regarding the sector of economic activity, manufacturing companies with low technological intensity, manufacturers with medium-low technological intensity, manufacturers with medium-high technological intensity and the extractive sectors are more likely to perceive obstacles to their innovation activities related to cost factors. In addition to these factors, manufacturers of low technological intensity and manufacturers of medium-high technological intensity tend to perceive more strongly the obstacle of lack of qualified personnel in the country. The results contrast with the literature reviewed, where companies operating in the manufacturing sector are characterized by having

a more technological nature, which leads to demanding economic resources, human resources, and other specific materials. A greater evaluation of the obstacles is more frequent in companies that belong to the most innovative sectors, or in those that have greater adoption of R&D and technology.

Companies that belong to knowledge-intensive services and service providers tend to perceive less the obstacles of lack of market information and markets dominated by other companies compared to non-knowledge-intensive service companies. This is because these companies develop innovations of a non-technological nature that are oriented towards the market, so their innovations do not require significant resources. Regarding the results of the province, the provinces that perceive the most obstacles to innovation associated with lack of funds, high costs of innovation activities, lack of financing, lack of qualified personnel, lack of information on technology, lack of information on markets, difficulties in finding partners for cooperation and uncertainty in demand are the provinces of Azuay, Cotopaxi, Chimborazo, El Oro, Esmeraldas, Loja, Morona Santiago, Napo, Tungurahua, Orellana, taking the province of Pichincha as a reference. On the other hand, the provinces that least perceive these obstacles are the provinces of Guayas, Los Ríos, Manabí, Pastaza and Santo Domingo de los Tsachilas. Talented workers are attracted to regions with a good quality of life. Therefore, many companies in certain geographical areas will perceive greater obstacles to innovation due to a lack of qualified personnel. Provinces with more concentrated industries will tend to have concentrated innovation. This concentration can occur in the following ways: natural resources, scale, transport costs, intensive in R&D, intensive in skilled labor and intensive in scientific knowledge.

5 Conclusions

The factors that influence the perception of barriers to innovation differ depending on the types of barriers of cost, knowledge, and market. Large companies are the ones that perceive the obstacles to innovation the least compared to medium-sized companies, especially the factor that they perceive the least is the lack of qualified personnel linked to theory. Large companies with their experience and know-how in the market tend to know their labor market, which means that they perceive it to a lesser degree. These companies have easier access to credit and capital, which justifies that they perceive these factors less intensely. In relation to small companies, they perceive the high costs of innovation more intensely. In relation to age, it is important to mention that as companies grow old, they perceive fewer obstacles to innovation in relation to lack of funds, financing, lack of qualified personnel, market dominated by established companies and uncertainty, contributing especially to their experience.

Regarding cooperation, this is a factor that allows companies to benefit from additional resources that they can allocate to innovation activities, and, in the case of Ecuadorian companies, it is important to note that companies that cooperate with institutions and other companies, they perceive more obstacles to innovation. Other important considerations are that, in relation to non-innovative investment companies, they perceive the cost, knowledge and market factor to a lesser degree, which is justified by the theory that states that companies that do not participate in innovation processes tend to underestimate their obstacles. In relation to the sector to which a company belongs, the theory

repeatedly mentioned that manufacturing companies perceive more obstacles related to the cost factor. In Ecuador, this result is reiterative, but significantly in manufacturers of low technological intensity. The justification is due to the fact that these companies, in order to survive in the market, constantly need to invest in innovation, which entails a demand for greater financing and investment.

Finally, it is important to consider that these analyzes, and contributions are for a developing economy and provide an action guide for possible public policies that can focus their efforts and actions to encourage and develop innovative activity in the country. Future research should consider deepening the study of the barriers to innovation, taking into account current market trends resulting from globalization and the technological change itself that is affecting due to the constant updates and challenges faced by companies in different sectors but that must be taken into account due to their importance in business competitiveness. The limitations of the present study are related to the database (ACTI), a survey that was applied for the last time in 2014 and there is no current data available that allows for an in-depth investigation to obtain relevant information applicable to companies.

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