The Impact of conglomerates and economic groups in innovative activities: Evidence of the Colombian Manufacturing and Services Industry

Abstract

This document explores the role of conglomerates in the innovative performance of companies in the manufacturing industry and the service sector in Colombia. The results indicate that the composite conglomerates facilitate the complete mechanism of innovative performance, although they are more likely to generate adverse effects on process innovations in the manufacturing sector and positive effects on product innovations generated by the services sector. In short, conglomerates are important for innovative performance, but they have a purpose in mitigating the obstacles of cooperation and regulation of the elements that stimulate innovative performance. These results will be analyzed from the number of companies reported in the Technological Development and Innovation Survey for the manufacturing and services industry (EDIT and EDITS), for the years 2017-2019. This database is made up of a cross-section of 7,529 industrial companies and 9,304 companies in the services sector, which are part of the DANE directory.

Keywords: Conglomerates, Innovation, manufacturing industry, service sector.

Introduction

Conglomerates (GAF) are defined as the set of legally independent companies that come together for a common purpose, which includes property, transactions, or family and friendship relationships to achieve a collegiate objective (Leff, 1978 ; Granovetter, 1995; Yiu, Lu, Bruton and Hoskisson , 2007. p. 1553). In this way, conglomerates or economic groups constitute a way of concentrating ownership or coordinating objectives and strategic planning. Several factors allow the consolidation of economic groups or conglomerates, among which the concentration of owners, economic synergies, coordination mechanisms, and autonomy stand out. These factors allow conglomerates to adapt to the economic context and even dominate the market; Thus, the stronger these factors become, the more willing there will be to overcome some of the obstacles that companies face when innovating. The concentration of owners based on trust relationships allows control and monitoring of resources to flow between the economic group and the majority owner, while economic and technological synergies allow strategic decision-making between companies, maximizing economies of scale and scope, and the financial management of the economic group (Cainelli and Iacobucci , 2011; Daems , 1978; Yiu et al., 2007; Williamson, 1975); For its part, the coordination between the company and the economic group allows the creation of some administrative mechanisms such as adequate information systems, procedures, planning and direct supervision (Cainelli and Iacobucci , 2011; Carney , Gedajlovic , Heugens , Van Essen and Van Oosterhoutm , 2011; Morck et al., 2005; Zona, Boyd, and Haynes , 2019). Finally, the autonomy of its affiliates allows the economic group to make autonomous operational and sometimes even strategic decisions (Cainelli and Iacobucci , 2011, Belenzon , Hashai and Patacconi , 2019; Miyajima and Kawamoto , 2010).

In emerging countries, research on economic conglomerates has been concerned with explaining the evolutionary process, leaving aside strategy and diversification as fundamental elements of construction and business fabric (Wilches & Rodríguez, 2016). However, some studies have ratified the importance and power generated by economic groups in the economy of emerging countries.

In Colombia, economic groups are characterized by having structures controlled by family groups which exercise their governance from a board of directors which is appointed according to the assets of the company and the relationship produced by external directors (Collin, 1998) The behavior depends largely on the nature of the firm and its affiliation to groups through vertical integration, which have a large part of the market and influence the organization and decision-making. In terms of function and organizational form, groups focus on decentralized management and economic units responsible for adaptability and market dominance in both developing and developed countries (Caney, Gedajlovic, Heugens, Essen, & Ossterhout, 2010; Castellacci , 2015).

This document explores the role of conglomerates in the innovative performance of companies in the manufacturing industry and the service sector in Colombia. The results indicate that composite clusters facilitate the full mechanism of innovative action, although they are more likely to generate adverse effects on process innovations in the manufacturing sector and positive effects on product innovations generated by the services sector. In short, clusters are important for innovative performance, but they serve the purpose of mitigating cooperation and regulation obstacles to the elements that stimulate innovative performance. These results will be analyzed based on the number of companies reported in the Technological Innovation and Development Survey for the manufacturing and services industry (EDIT and EDITS), for the years 2017-2019. This database is made up of a cross-sectional sample of 7,529 industrial companies and 9,304 companies in the service sector, which are part of the DANE directory.

This article is divided into four sections. The first section presents the theoretical framework to evaluate the role of conglomerates in the innovative performance of companies in the manufacturing industry and the service sector in Colombia. The second section has the econometric model and discusses the strategy of identifying the estimated effects in the zero-inflated Poisson model. The third section shows the descriptive statistics. Finally, the fourth section presents and analyzes the results of the research.

Literature review

Economic groups, organization, and research challenges

The literature review teaches us that economic groups generate some positive results among their members. The first result tells us that the interaction between the concentration of owners, economic synergies, coordination mechanisms, and their autonomy generates exchanges of financial, technical, and administrative resources in the organization of GAFs, efficient cooperation between supplier networks and buyers (Cainelli and Iacobucci , 2011; Chittoor , Kale, and Puranam , 2015; Morck , Wolfenzon , and Yeung , 2005). In addition to the social strengthening of their members, economic groups improve trust, promote collaboration, reduce uncertainty, reduce transaction costs and discourage parasitism (Khanna and Palepu , 1999; Granovetter, 1995, 2005).

Generating a GAF is quite a challenge. For this, it is necessary he rules of conformation must be clear in the establishment of the economic group, such that the connections between its members are not hindered and activities are promoted that mitigate the obstacles that may promote cooperation and regulation for the development of economic groups. innovation processes in the conglomerate and companies (Borda, Geleilate , Newburry & Kundu , 2017; Cefis et al., 2009, p.209). So, when the mechanisms of concentration, economic synergy, coordination, and autonomy are weak in the conglomerate, being affiliated does not guarantee that the effects of the obstacles that impede innovative performance, internal coordination of the effort to innovate and access to resources will be mitigated. (Cefis et al., 2009; Guzzini and Iacobucci , 2014a) .

The promotion of innovative performance promoted by economic groups can be seen permeated by the multiple functions that an economic group covers, such as the economic focus that they retain in business support (Guzzini and Iacobucci , 2014) , managerial capacity (Rajan, Servaes and Zingales , 2000; Stein, 1997). ; Williamson, 1975), tunneling (Bertrand, Mehta , and Mullainathan , 2002; Johnson, La Porta, Lopez -de-Silanes, and Shleifer , 2000), and the low level of technological synergies, innovation coordination, and resource mobilization among subsidiaries (Cefis et al., 2009; Cainelli and Iacobucci , 201).
Therefore, there is no clear evidence that economic groups produce an immediate effect in mitigating the obstacles that affect innovative performance. For this reason, this document will explore the role of conglomerates in the innovative performance of companies in the manufacturing industry and the service sector in an emerging country.

The path of obstacles
There are different studies regarding the factors that prevent companies from developing innovation activities; The literature has associated the Financial System as a limiting factor in the participation of R&D by firms. (Bond, Harhoff, and Van Reenen, 2003; Czarnitzki, Hottenrott, and Thorwarth, 2011; BH Hall, 2002; LA Hall and Bagchi-Sen, 2002; Hottenrott and Peters, 2012); Bond, Harhoff, and Van Reenen, 2003; Czarnitzki, Hottenrott and Thorwarth, 2011; BH Hall, 2002; LA Hall and Bagchi-Sen, 2002; Hottenrott and Peters, 2012)

However, Hottenrott and Peters (2012) found that companies with greater innovative capacity have more limitations than those with less capacity. A result that is associated with low levels of investment, especially in terms of innovation, which means that innovating implies large financial outlays with high levels of uncertainty about results and benefits, for those firms with greater internal liquidity (Nightingale and Coad, 2013)

The opposite happens in small and medium-sized companies; their capital is related to low levels of investment and financial restrictions. SMEs tend to have less qualified human resources and a lack of training and capacity development activities (Vossen, 1998); therefore, it becomes necessary to maintain a constant link with economic actors and public institutions that promote and facilitate learning and the incorporation of knowledge to innovate (Dini, Stumpo and Italiana, 2011).

Other recent innovation studies have identified that other obstacles affect innovation processes in firms (Blanchard et al., 2013). The study by (García-Quevedo, Pellegrino and Savona, 2016) captures different scenarios such as the effect of market hurdles, deficiencies in market attraction mechanisms, regulatory hurdles, and performance hurdles. Following the Oslo Manual prepared by the OECD 2005, innovation obstacles are classified into four (4) groups; Cost barriers related to the transformation process, Market barriers that refer mainly to demand (improvement of product quality, increase in market share, and penetration of new markets), Institutional barriers related to supply, such as the reduction of costs and increase of production capacity and finally the barriers of Knowledge that refers to the intellectual protection of innovations (patents).

Other studies on barriers to innovation in such contexts are relatively rare. However, there are some studies on barriers to growth (Levy, 1993) and technological development (Lall, Barba-Navaretti, & Wignaraja, 1994) that are of some relevance. This means that the obstacles are diverse although normally complementary. Said study suggests formulating policies from an integrating framework instead of focusing on the market effects associated with information and technology asymmetries caused by financial restrictions (Arza & Lopez, 2018).

It is evident that the variety of obstacles allows us to conclude the heterogeneity of the innovation processes; however, the literature lacks studies that assess whether these obstacles that affect innovation differ in companies with different profiles (ownership, size, age, and productive activities).

Factors that hinder the propensity to innovate: Barriers to Innovation

The barriers can act on one or more points of the innovation process. If this process is viewed as a simplified linear sequence of stages from innovation adoption to implementation, the effect of a barrier is likely to be greater at one stage than another. For example, lack of funding is likely to have a greater effect at the implementation stage. The assumption behind the barriers approach is that eleven inhibitors to innovation are identified, their effect is understood, and steps are taken to remove them. Then the natural flow of innovation will be restored. However, innovation requires motivation, extraordinary effort, and risk-taking to continue (Tidd, Bessant, & Pavitt, 2005). It is not an automatic or spontaneous process. In some cases, barriers may even act as more innovation stimulators than inhibitors. Successful innovation has been associated with subsequent growth and thus with firm performance (Freeman, 1982). Barriers to innovation are then expected to negatively affect a company's economic performance as well. Reserving its possible positive effect, the success of the innovation means that, in some cases, the direction of the association between barriers and performance is inconclusive.

Small and medium-sized enterprises (SMEs), even in industrialized countries, are expected to face relatively more barriers to innovation than large companies due to inadequate internal resources and expertise. For this reason, more emphasis has been given to SMEs when studying their barriers to innovation. Therefore, SMEs need to obtain technology and resources from external sources through strategic networks and, therefore, the interactive character of innovation in their case is even more intense than in large companies (Rothwell and Dodgson, 1991). It is assumed that the greater the importance of the barriers, the greater the propensity to network. In less developed countries, SMEs face, in addition to the problems mentioned, inadequate technological and policy infrastructure. Studies on barriers to innovation in such contexts are relatively rare. However, there are some studies on barriers to growth (Levy, 1993) and technological development (Lall, Barba-Navaretti, & Wignaraja, 1994) that are of some relevance. Barañano (2005) revealed two barriers to innovation when I conducted a study on five Portuguese SMEs.

Previous empirical studies investigating the role of the obstacle in the innovation process have largely highlighted the determinants of the importance of barriers to innovation (Baldwin and Hanel, 2003; Galia and Legros, 2004; Iammarino, Sanna-Randaccio , & Savona, 2009) and the impact of barriers, mainly financial barriers, on the propensity to innovate and/or the degree of novelty of innovation (Mancusi & Vezzulli, 2010; Mohnen, Palm, van der Loeff, & Tiwari , 2008; Savignac, 2008).

On the other hand, D'este et al. (2012) approached this question in a very different way by distinguishing between revealed and dissuasive barriers to innovation. The revealed barriers interpretation holds that "engagement in innovation activity increases firms' knowledge" of associated difficulties (i.e., increases awareness and knowledge of factors limiting innovation through the "revealing" outcome). "or" learning "from direct experience), although it does not prevent them from engaging in innovation activities or being successful innovators" (D'este et al., 2012: 483). From the perspective of dissuasive barriers, the obstacles are interpreted as inducing dissuasive effects on the innovation activities of companies.

Companies have many significant internal and external obstacles. Internal obstacles are usually associated with difficulties in implementing internal changes in your management and organizational practices (for example, lack of trained company staff, lack of innovation management training, and cultural rigidity to change). In contrast, external obstacles to innovation (for example, lack of financing, cost of innovation, long payback period, lack of qualified personnel) can arise when companies acquire resources and knowledge from external sources (Thakur & Hale , 2013).

According to what was stated in the innovation and technological development surveys, several categories of obstacles can be defined: Financial, knowledge, demand, regulatory, and market. The knowledge obstacle is related to the lack of technological information, in the markets, public support instruments, and qualified personnel. In knowledge-intensive industries, innovation is due to the ability to combine, in a single new body of knowledge, tacit with codified knowledge, old knowledge with new and internal knowledge with external knowledge (Amara et al., 2009; Anand, Gardner, & Morris, 2007; Miles, 2005). We suggest that the ability to combine these different kinds of knowledge in new ways could be hampered by lack of access to skilled employees, lack of information about markets, and lack of information about technologies.

The financial obstacle is interpreted in terms of the lack of internal resources, the possibility of innovation, and the difficulties in accessing external financing for the company, and the cooperation obstacle is explicit in terms of the limited possibilities of cooperation with other companies or institutions. On the other hand, the regulatory obstacle includes aspects related to the low offer of inspection services, tests, certifications, and others, the difficulties that the company has in complying with the regulations and the ease of imitation and deficiency in the protection of the business. Intellectual property. Finally, the demand barrier is related to the uncertainty regarding the demand for innovative goods and services, the technical execution of the project, and the risk of not finding buyers or uncertainty in this regard. With market barriers, this group of obstacles refers to the intensity of competition (Dean, Brown, & Bamford, 1998; D'Este et al., 2012). The intensity of competition can be related to many factors, such as the ease with which customers can substitute their products for competing products, the constant threat created by the arrival of new competitors, the constant threat created by the arrival of products from the competition, the rapid obsolescence of products and the rapid changes in production technologies.

Method: The Zero Inflated Poisson models

The Poisson model, the most basic of the models applied to these characteristics, is feasible. It is a model applied to counting models, of a discrete and non-negative nature. This model attributes positive probabilities to zero values and has a non-negative random variable for heteroskedasticity and skewed distribution. Finally, this model has a simple structure, and the model parameters can be estimated with relative ease.

The number of innovations, which is the dependent variable of analysis, is count data, discrete, and has non-negative values. Therefore, it is possible to postulate that its distribution fits the characteristics of a Poisson process. Following Winkelmann (2008, pg 8), Poisson models are characterized by equidispersion, that is, their mean and variance are equal, and the probability of a count is determined by a Poisson distribution, where the mean of the distribution is a function of the independent variables (Scott, 1997, p. 217). Winkelmann (2008) argues that if " y"is a random variable with a discrete distribution defined in $N\ U\ \{0\} = \{0,1,2\ ...\}$, then the set Y has a Poisson distribution with parameter μ, written as $X \sim Po(\mu)$, if the probability function is:

$$P(y|\mu) = p_y = \frac{e^{-\mu}\mu^y}{y!} \qquad (1)$$

For μ belonging to the positive reals y, $y = 0,1,2 \dots ..$, y the probability function is given by

$$P(s) = E(s^y) = \sum_{y=1}^{\infty} \frac{e^{-\mu}(\mu s)^y}{y!} = e^{-\mu+\mu s} \qquad (2)$$

We can calculate the expected value or first moment of the distribution and its variance.

$$E(Y) = P'(1)$$

$$P'(1) = \frac{\partial P(s)}{\partial y} = e^{-\mu}\ \mu\ e^{\mu s} \qquad (3)$$

If s=1, we can say that:

$$\frac{\partial P(s)}{\partial y} = e^{-\mu}\ \mu\ e^{\mu} = \mu \qquad (4)$$

On the other hand, the variance is equal to:

$$Var(Y) = P''(1) + P'(1) - [P'(1)]^2 \qquad (5)$$

$$P''(1) = \frac{\partial^2 P(s)}{\partial s^2} = e^{-\mu}\ \mu^2\ e^{\mu s} \qquad (6)$$

If s=1, we can say that:

$$Var(Y) = \mu^2 + \mu - [\mu]^2 = \mu \qquad (7)$$

These results allow us to show the characteristic of a Poisson model: its equidispersion. In practice, as happens with the count of innovations (Poisson distribution), according to the descriptive statistics, the variance exceeds the mean and there is a high percentage of zeros in the distribution, which indicates an overdispersion of the data (variance greater than the mean). Because the variance is larger than the mean, empirical evidence shows that the Poisson model rarely predicts in practice.

By introducing the subscript i, together with "y" and μ, in the framework of independent and identically distributed variables, it can be extended to the case of regression. Thus, the Poisson regression model is derived from the Poisson distribution by parameterizing the relationship between the mean of parameters $\mu$and regressors. The standard assumption is to use the exponential mean parameterization:

$$\mu_i = e^{(x_i\beta)}; i = 1, \dots N \qquad (8)$$

assuming there are K linear independent variables, usually including a constant. Since $V[y_i|x_i] = e^{(x_i\beta)}$, the Poisson regression is heteroskedastic.

Let,

$$P(y|\mu) = p_y = \frac{e^{-\mu}\mu^y}{y!} \qquad (9)$$

$$\mu_i = e^{(x_i{'}\beta)}; i = 1, \dots N \qquad (10)$$

and if the observations $(y_i|x_i)$are independent, the most natural estimator is the one with maximum likelihood. The likelihood function for a Poisson is:

$$LnL(\beta) = \sum_{i=1}^{N} \left[y_i x_i{'}\beta - e^{(x_i{'}\beta)} - Lny_i!\right] \qquad (11)$$

The maximum likelihood Poisson estimator, $\widehat{\beta_P}$, is the solution to the first-order condition of the likelihood function, which is:

$$\sum_{i=1}^{N} \left[y_i - e^{(x_i{'}\beta)}\right]x_i = 0 \qquad (12)$$

if it $x_i$includes a constant term, then the residuals $y_i - e^{(x_i{'}\beta)}$add to zero by the first-order condition. The likelihood function is globally concave, so solving this equation using some iterative method yields estimates of the parameters. The result also allows us to infer that $E[x_i] = e^{(x_i{'}\beta)}$, where the interpretation of the coefficient is obtained from:

$$\frac{\partial E[x_i]}{\partial x_j} = \beta_j e^{(x_i{'}\beta)} \qquad (13)$$

$\hat{\beta}_P$is consistent to $\beta_P$and asymptotically normal with variance:

$$\widehat{V\beta_P} = \left(\sum_{i=1}^{N} \mu_i x_i x_i{'}\right)^{-1} \text{with} \mu_i = e^{(x_i{'}\beta)} \qquad (14)$$

The fact that the innovation is a count variable does not imply that Poisson models are not both a necessary and sufficient condition (Winkelmann, 2008 pg. 65). For example, right-censored exponential regression models with continuous variables can be estimated with a Poisson, which implies that they can be used for non-counting dependent variables. It is also possible that some models allow many inferences, with the probability of occurrence of some values (such as zeros), respecting the dispersion between the variance and the mean, and with which there is a particular interpretation in the process. data structure generator. These results of the observations mean that the Poisson model is no longer the best and if the calculations of the mean are correct, but there is overdispersion, the estimators of a Poisson model are consistent but inefficient (Scott, 1997).[1]

There are many observations of zero in the dependent variable (68% manufacturing and 83% services), that is, not all companies innovate despite the benefits of doing so. However, having many non-innovative signatures is not a problem if the fact that the variable takes the value 0 can be interpreted in two different ways, in such a way that we maintain the condition that occurs for a certain data generation process. When this is the case, zero-inflated models (Zero-inflated Poisson ZIP, model or Zero-inflated negative binomial ZINB) can provide better results than Poisson and/or negative binomial models, since they do not take into account in the estimation of these possible differentiating aspects, while the inflated zeros assume that the dependent variable is the product of a binary law and a Poisson law or negative binomial (Melgar and Guerrero, 2005).

The zeros in the innovation count can be given by two processes. A process that can be understood as negligence (in a good way) and another for structural reasons. Interpreting the distributions of Lambert (1992) we can say that the ZIP model breaks down into two models. The first estimates a standard Poisson model, whether there are null values in the distribution. Within the context, this part of the model captures the decision to innovate regardless of whether the firm has generated a strategy that allowed it to meet this objective. The second model is a logit that allows defining the probability of not innovating in two ways: negligence and structural nature.

Data

The sample is made up of the number of companies reported in the Technological

[1] However, by methodological recommendation, the Logit, probit, and Poisson models will be estimated, which can be developed theoretically with the tools available in the advanced econometrics course.

Development and Innovation Survey for the manufacturing and services industry (EDIT and EDITS), for the years 2017-2019. This database is made up of a cross-section of 7,529 industrial companies and 9,304 companies in the services sector, which are part of the DANE directory. The objective of these surveys is to characterize the dynamics of technological development of the manufacturing and service companies in Colombia, in terms of intensity and trajectory of innovation and technological development activities, to evaluate the incidence of public policy instruments, and to establish the types of occupational profiles applied in the different areas or departments of the companies.

In this study, innovative performance in products, processes, markets, and organizations is used as a dependent variable, in a binary context (1= yes, it innovates; 0= otherwise) and on a discrete, non-negative scale (innovation count). Counting marketing innovations, this variable is characterized by a high number of zero observations and few observations with high positive values, so it could be inferred that it follows a negative Poisson or binomial distribution. From the dependent variable, it will be observed that there is a causal relationship between the conglomerates and the variation of the innovative performance.

From the information available in the EDIT and EDITS, the dependent and independent variables to use are the following:

Dependent variables:

1. Count of innovations in products, processes, markets, and organizations of the firms. Source: EDIT -EDITS for the years 2017-2019.
2. Binary of not innovating in products, processes, markets, and organizational firms (1= does not innovate; 0= Innovates). Source: EDIT -EDITS for the years 2017-2019.

Independent variables. To explore:

1. Company size: Number of company employees in logarithms. Source: EDIT -EDITS for the years 2017-2019.
2. Source of vertical ideas: Equal to 1 if the company uses customers or suppliers as sources of information for innovation. Equal to 0 otherwise. Source: EDIT and EDITS for the years 2017-2019.
3. Source of ideas from universities and research centers: Equal to 1 if the company uses universities and R&D centers (Technological Development Centers -CDT and Research Centers) as sources of information for innovation. Equal to 0 otherwise.

Source: EDIT and EDITS for the years 2017-2019

4. Demand Push: It is a binary variable, equal to one if the company expresses as very important the improvement in the quality of the goods or services and the expansion in the range of goods or services offered (Griffith et al., 2006). Equal to 0 otherwise. Source: EDIT-EDITS for the years 2017-2019.
5. Highly qualified personnel refer to employed personnel with masters and doctoral degrees over the total personnel. Source: EDIT-EDITS for the years 2017-2019.
6. Qualified personnel: Refers to employed personnel with undergraduate training and specialization over the total personnel. Source: EDIT-EDITS for the years 2017-2019
7. R&D expenses: Logarithm of the investment in internal and external R&D activities. Source: EDIT-EDITS for the years 2017-2019.
8. Obstacles to Innovation: 5 dummy variables related to the category's knowledge, cooperation, demand, regulation, and financing self-reported obstacles. In each of them, the value of the variable is one if the company self-reports an obstacle related to that category and 0 otherwise.

For the construction of the obstacles, the following classification was used:

Table 1

Obstacles classification

Obstacle	Obstacle Type
Lack of qualified personnel	Knowledge
Lack of market information.	Knowledge
Lack of technological information.	Knowledge
Lack of information on public support instruments	Knowledge
Limited possibilities for cooperation with other companies or institutions	Cooperation
Uncertainty in the demand for innovative goods and services	Demand
Uncertainty about the success in the technical execution of the project	Demand
Lack of internal resources	Financial
Low profitability of innovation.	Financial
Difficulties in accessing external financing for the company	Financial

Low supply of inspection, testing, calibration, certification, and verification services	Regulator
Difficulty complying with regulations	Regulator
Ease of imitation by third parties.	Regulator
Insufficient capacity of the intellectual property system to protect innovation	Regulator

Sources: The authors, based on a theoretical review

9. Composite conglomerate: Variable that includes the participation of conglomerates through available resources, cooperation, and network generation.

Results

To accept or reject the hypothesis, a zero-inflated Poisson model will be performed, to maintain the nature of the dependent variable (non-negative discrete), a Poisson model will be performed. Tables 1 and 2 report the descriptive statistics of the variables described for the development of the models.

Table 2.

Descriptive statistics of the variables of the Colombian manufacturing industry

Variable	Obs	mean	Std. Dev.	min	Max
Total Innovations	7529	,684	2,252	0	56
product innovations	7529	,308	1,458	0	47
process innovations	7529	,218	,828	0	18
Organizational innovations	7529	,079	,395	0	10
marketing innovations	7529	,079	,342	0	6
Business size (logarithms)	7529	3,747	1,262	,405	8,352
R&D intensity (logarithms)	732	5,615	1,897	-1,23	10,884
Qualified personnel	7529	,29	,209	0	1
highly qualified staff	7529	,004	,014	0	.4
demand push	7529	,184	,388	0	1
vertical fonts	7529	,148	,355	0	1
University sources and centers	7529	,035	,183	0	1
composite conglomerate	1850	,134	,341	0	1
Knowledge obstacles	7529	,076	,265	0	1
Cooperation obstacles	7529	,044	,204	0	1

Demand obstacles	7529	,07	,255	0	1
financial obstacles	7529	.111	,314	0	1
Regulatory obstacles	7529	.082	,275	0	1

Source: EDIT 2018-2019

Table 3.

Descriptive statistics of the variables of the Colombian services sector

Variable	Obs	mean	Std. Dev.	min	Max
Total Innovations	9304	.83	6,273	0	436
product innovations	9304	.475	5,967	0	436
process innovations	9304	.105	.593	0	23
Organizational innovations	9304	.149	.648	0	32
marketing innovations	9304	.101	.419	0	11
Logistics Innovations	9304	.051	.26	0	5
Innovations in information processing	9304	.225	.798	0	23
Accounting Innovations	9304	.071	.313	0	8
Business size (logarithms)	9304	4,384	1,295	.405	9,296
R&D intensity (logarithms)	868	6,095	2017	-.157	12,678
Qualified personnel	9304	.422	.283	0	1
highly qualified staff	9304	.016	.062	0	1
demand push	9304	.242	.428	0	1
vertical fonts	9304	.179	.384	0	1
University sources and centers	9304	.054	.227	0	1
composite conglomerate	3008	.165	.371	0	1
Knowledge obstacles	9304	.082	.274	0	1
Cooperation obstacles	9304	.041	.198	0	1
Demand obstacles	9304	.074	.261	0	1
financial obstacles	9304	.121	.326	0	1
Regulatory obstacles	9304	.075	.263	0	1

Source: EDITS 2018-2019

The results of the zero-inflated Poisson models are presented in tables 3 and 4. The Schumpeterian hypothesis associated with the firm size is important in innovative performance, as are R&D intensity, demand drive, and sources of investment. vertical information from universities and research centers.

Table 4.

The Zero-inflated Poisson model Colombian manufacturing industry

	(one)	(two)	(3)	(4)	(5)	(6)	(9)	(10)
VARIABLES	inntot	inflate	ipto	inflate	iproc	inflate	iorg	inflate
Business size (logarithms)	0.164***	2,378	0.180***	0.310**	0.262***	0.169	0.137**	0.150
	(0.0145)	(1,558)	(0.0227)	(0.132)	(0.0330)	(0.163)	(0.0549)	(0.186)
R&D intensity (logarithms)	0.0686***	2,950*	0.138***	0.0631	0.0379	-0.0109	- 0.0942**	-0.0309
	(0.0119)	(1,623)	(0.0199)	(0.112)	(0.0264)	(0.117)	(0.0452)	(0.151)
Qualified Personnel	0.222*	-53.70**	0.0141	-1,367	-0.0128	-0.253	0.959**	0.0284
	(0.119)	(27.19)	(0.174)	(0.960)	(0.277)	(1,362)	(0.487)	(1,539)
highly qualified staff	1,230	-415.8	0.0234	-4,940	0.0988	-8,415	1,545	9,996
	(1,099)	(274.9)	(1,566)	(10.44)	(2,639)	(16.42)	(4,136)	(18.08)
Demand Push	1,231***	-250.9	0.809**	-3.947***	0.382	- 3,035***	1,442***	16.30
	(0.124)	(0)	(0.359)	(0.534)	(0.318)	(0.673)	(0.268)	(2,177)
Vertical Fountains	0.294***	28.53**	0.339***	-0.420	0.288***	0.560	0.0769	0.282
	(0.0460)	(13.01)	(0.0740)	(0.318)	(0.104)	(0.543)	(0.170)	(0.527)
Sources of Universities and Centers	0.309***	8,608	0.190***	-0.410	0.669***	1,479**	0.304*	-0.109
	(0.0424)	(5,336)	(0.0614)	(0.372)	(0.105)	(0.600)	(0.172)	(0.537)
composite conglomerate	0.136**	23.99**	-0.00608	-0.963*	-0.210*	-0.698	0.312	-1,451*
	(0.0575)	(11.54)	(0.0853)	(0.513)	(0.125)	(0.594)	(0.255)	(0.747)
knowledge hurdle	-0.164***	-2,716	-0.0794	0.361	-0.105	0.722	- 0.504***	-14.89
	(0.0561)	(6,650)	(0.0844)	(0.409)	(0.122)	(0.545)	(0.187)	(1,132)
cooperation obstacle	-0.0487	-27.41	-0.210**	-1,081	0.253	-0.0121	-0.237	-0.963
	(0.0683)	(18.96)	(0.102)	(0.823)	(0.157)	(0.716)	(0.233)	(2,290)
demand hurdle	0.123**	29.72**	0.142*	0.273	0.0909	-0.242	-0.232	-2,769
	(0.0527)	(14.05)	(0.0748)	(0.382)	(0.111)	(0.511)	(0.215)	(4,569)
financial hurdle	0.0134	-21.70*	0.0189	-0.304	-0.265**	-0.808	-0.344*	-16.73
	(0.0525)	(11.15)	(0.0778)	(0.406)	(0.125)	(0.674)	(0.194)	(2,148)
regulatory hurdle	0.0507	21.27*	0.0320	-0.290	-0.0936	0.201	0.275	-0.155
	(0.0534)	(11.72)	(0.0755)	(0.396)	(0.116)	(0.513)	(0.182)	(0.693)
Knowledge Obstacle X Cluster	-0.141	12.68	-0.304*	-0.0332	-0.266	-1,200	0.973***	16.32
	(0.109)	(0)	(0.162)	(0.930)	(0.233)	(1,058)	(0.370)	(1,132)
Cooperation ObstacleX Cluster	-0.0308	-58.86	0.179	-0.532	-0.857**	-0.338	0.454	1,191
	(0.131)	(0)	(0.178)	(1,477)	(0.346)	(1,514)	(0.553)	(2,416)
Demand hurdleX conglomerate	0.133	42.98	-0.125	-1,299	0.610***	1,425	0.453	2,107
	(0.0904)	(0)	(0.131)	(0.946)	(0.195)	(0.947)	(0.326)	(4,594)
Financial hurdleX conglomerate	-0.152*	-13.85	-0.104	1,388*	0.0829	0.0832	-0.0826	16.20
	(0.0915)	(1,719e+09)	(0.133)	(0.770)	(0.205)	(1,078)	(0.369)	(2,148)
Regulatory hurdleX cluster	0.0333	65.61	0.406***	1,306*	-0.104	-0.237	-0.483	1,018
	(0.0857)	(2,855e+09	(0.119)	(0.758)	(0.189)	(0.814)	(0.335)	(0.958)

		)						
Constant	-1,382***	-36.33**	-1,807***	1,244	-1,862***	-0.267	-2.377***	-16.89
	(0.155)	(18.30)	(0.395)	(0.900)	(0.397)	(1,229)	(0.422)	(2,177)
Remarks	732	732	732	732	732	732	732	732

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

In terms of composite clusters, they facilitate the full mechanism of innovative performance, although they are more likely to generate adverse effects on process innovations in the manufacturing sector and positive effects on product innovations generated by the services sector. In the case of obstacles, the manufacturing industry is permissive with those of demand in total and product innovations and dissuasive with those of knowledge in total and organizational innovations, those of cooperation in product innovations, and financial ones in process and organizational innovations. For the service sector, knowledge barriers are permissive to total and product innovations; those of cooperation are dissuasive to process innovations. The demand obstacles are dissuasive to total and organizational innovations, while the financial ones to total and product innovations; Finally, regulatory obstacles are dissuasive to total, product, and organizational innovations.

Table 5.

The Zero-inflated Poisson model Colombian services sector

	(one)	(two)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	inntot	inflate	ipto	inflate	iproc	inflate	icom	inflate	iorg	inflate
Business size (logarithms)	0.354***	0.103	0.395***	0.130	0.358***	0.00536	0.343***	0.293*	0.268***	0.189
	(0.0120)	(0.161)	(0.0156)	(0.0956)	(0.0408)	(0.0977)	(0.0548)	(0.163)	(0.0391)	(0.155)
R&D intensity (logarithms)	0.163***	0.292**	0.195***	0.153**	0.152***	0.0436	0.102**	0.0744	0.0802***	0.156
	(0.00862)	(0.116)	(0.0111)	(0.0629)	(0.0282)	(0.0665)	(0.0418)	(0.131)	(0.0290)	(0.116)
Qualified Personnel	0.705***	0.172	0.424***	-3,431***	0.307	0.153	0.325	0.471	0.430	1,062
	(0.105)	(1,045)	(0.165)	(0.603)	(0.312)	(0.683)	(0.422)	(1,672)	(0.278)	(1,064)
highly qualified staff	3,035***	-0.823	3,394***	-8.655***	-0.0486	1,542	-0.323	2,209	-0.209	-0.785
	(0.116)	(1,737)	(0.166)	(1,437)	(0.447)	(0.955)	(0.840)	(2,237)	(0.417)	(1,573)
Demand Push	1,164***	-2.752***	0.722***	-3.674***	2,750***	13.22	1,464***	2,548	1,463***	13.01
	(0.155)	(0.455)	(0.267)	(0.497)	(0.313)	(584.3)	(0.304)	(3,538)	(0.202)	(1,209)
Vertical	0.133	-0.335	-	-	-0.0415	-0.636**	-0.360**	-1.553***	0.00250	-0.714*

Fountains	***		0.0256	0.732***						
	(0.0389)	(0.441)	(0.0520)	(0.253)	(0.148)	(0.283)	(0.171)	(0.530)	(0.119)	(0.409)
Sources of Universities and Centers	0.326***	-0.551	0.391***	-0.220	0.140	-0.0355	0.292	0.742	0.534***	0.253
	(0.0375)	(0.487)	(0.0496)	(0.280)	(0.129)	(0.291)	(0.195)	(0.622)	(0.121)	(0.455)
composite conglomerate	0.220***	0.126	0.231***	-0.145	-0.116	-0.154	-0.0730	1,149	-0.0366	-1.237***
	(0.0442)	(0.584)	(0.0550)	(0.323)	(0.171)	(0.372)	(0.235)	(0.769)	(0.149)	(0.471)
knowledge hurdle	0.323***	0.479	0.493***	0.428	0.124	0.295	-0.0237	-0.157	-0.0783	-1,481
	(0.0558)	(0.580)	(0.0784)	(0.380)	(0.174)	(0.371)	(0.238)	(0.722)	(0.154)	(1,254)
cooperation obstacle	-0.0260	0.0997	-0.0715	-0.0951	-0.559**	-1,640*	-0.128	-0.715	-0.165	-13.85
	(0.0853)	(1,022)	(0.120)	(0.536)	(0.283)	(0.876)	(0.312)	(0.895)	(0.186)	(813.2)
demand_barrier	-0.158***	-0.935	-0.0851	0.343	0.123	0.484	-0.0501	-0.821	-0.310*	-1,961
	(0.0566)	(0.887)	(0.0783)	(0.381)	(0.172)	(0.359)	(0.256)	(0.796)	(0.169)	(1,496)
financial hurdle	-0.187***	0.0481	-0.537***	-0.639*	0.0875	0.0412	0.459**	1,605**	0.154	-0.639
	(0.0509)	(0.532)	(0.0694)	(0.368)	(0.167)	(0.322)	(0.228)	(0.737)	(0.143)	(0.567)
regulatory hurdle	-0.154**	-0.312	-0.227***	-0.634	-0.0961	-0.442	0.261	1,292*	-0.283*	-14.40
	(0.0626)	(0.740)	(0.0880)	(0.414)	(0.190)	(0.417)	(0.252)	(0.740)	(0.145)	(907.0)
Knowledge Obstacle X Cluster	-0.736***	-1,494	-1.088***	-1,398**	-1.063***	-2,913	-0.492	-1,900	0.00171	-0.454
	(0.0806)	(1,153)	(0.110)	(0.693)	(0.304)	(2,145)	(0.365)	(1,516)	(0.239)	(1,868)
Cooperation ObstacleX Cluster	0.332***	2,171	0.525***	1,238	1,152***	3,278***	0.281	-1,347	-0.134	14.47
	(0.120)	(1,479)	(0.161)	(0.904)	(0.420)	(1,233)	(0.468)	(1,526)	(0.377)	(813.2)
Demand hurdleX conglomerate	0.0226	-0.301	-0.197*	-1.167*	-0.221	-1,444**	0.879**	1,599	0.467*	1,841
	(0.0778)	(1,372)	(0.104)	(0.668)	(0.239)	(0.715)	(0.343)	(1,010)	(0.242)	(1,581)
Financial hurdleX conglomerate	-0.530***	-1,095	-0.407***	-0.124	-0.421	-0.797	-0.619*	-0.988	-0.430**	-0.314
	(0.0707)	(0.972)	(0.0933)	(0.652)	(0.257)	(0.654)	(0.351)	(0.985)	(0.216)	(0.931)
Regulatory hurdleX cluster	0.897***	1,410	1,123***	1,805***	0.712***	1,214*	-0.304	-3,050**	0.322	15.66

	(0.0766)	(1,003)	(0.102)	(0.647)	(0.260)	(0.714)	(0.350)	(1,215)	(0.239)	(907.0)
Constant	-3.614***	-2,524	-3,781***	3,844***	-5.608***	-13.11	-4.652***	-6,150	-3,793***	-15.26
	(0.184)	(1,582)	(0.308)	(0.921)	(0.450)	(584.3)	(0.603)	(4,390)	(0.365)	(1,209)
Remarks	868	868	868	868	868	868	868	868	868	868

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

In terms of the interaction between the obstacles and belonging to a conglomerate, the interactions are favorable: the interaction between the conglomerates and the cooperation obstacles in total, product and process innovations, and the interaction between the conglomerates and the regulatory obstacles that They operate in the service sector. In the manufacturing sector, the positive effects of interactions between clusters and knowledge barriers on organizational innovations, interactions between clusters and demand barriers on process innovations, and interactions between clusters and barriers are highlighted. of regulations on product innovations.

In short, conglomerates are important for innovative performance, but they have a purpose in mitigating the obstacles of cooperation and regulation of the elements that stimulate innovative performance. The results support the intensity of some dimensions developed by BG, which depend on the characteristics of the country of origin. This is consistent with the objective of conglomerates in an emerging country like Colombia, where private companies are affiliated with non-financial business groups controlled by the family, their level of governance lies with the board of directors according to the performance of assets. of the company and the relationship produced by external directors (Pombo & Gutiérrez, 2011). Similarly, the results show the role of conglomerates in the centralization and joint management of strategic projects (eg, innovations) or functions (eg, finance) as other coordination mechanisms (Cainelli and Iacobucci, 2011), where the internal network of links allows the coordinated exchange of actions and resources between the GAF (Chen and Jaw, 2014; Khanna and Rivkin, 2001; 2006; Mahmood, Zhu and Zaheer, 2017; Mahmood, Zhu and Zajac, 2011). Likewise, group affiliation does not guarantee internal coordination of innovative activities and access to BG resources (Cefis et al., 2009; Guzzini and Iacobucci, 2014a).

Thus, this research contributes to the state of the art of innovative performance by showing one of the channels where innovation promotion networks allow dissuading the adverse effects of some problems that companies face when innovating.

Discussion

To address the organizational form of the GAF, it is essential to name the incidence of the organizational form of BG, which is adequate to facilitate the exchange of internal resources between GAF. The organization of the GAF depends to a certain extent on different factors; Among them, the voting rights that grant the final owner discretionary power to mobilize resources to stand out (Cainelli and Iacobucci, 2011; Chittoor, Kale and Puranam, 2015; Morck, Wolfenzon and Yeung, 2005) and the types of links between affiliates and coordination mechanisms, which allow the internal mobilization of resources (Khanna and Rivkin, 2001), these are led by headquarters through the unitary direction, in charge of controlling the resource allocation process (Cainelli and Iacobucci, 2011; Manikandan and Ramachandran, 2015).

It is relevant to highlight the interconnection that the GAF boards present, the financial links between buyers and suppliers that help the coordination of the group and act as conduits for the exchange of resources (Khanna and Rivkin, 2006; Khana and Thomas, 2009; Mahmood et al. al., 2013; Zone, Boyd and Haynes, 2019). In addition to informal social ties, within-group members, and recurring intragroup trade that enhance interpersonal trust, promote collaboration, reduce uncertainty, and allow FAGs to lower transaction costs and discourage free-riding (Khanna and Palepu, 1999; Granovetter, 1995, 2005).

Therefore, GAFs become “networks whose prevalence facilitates the creation of “trust” as Khanna and Yafeh (2007) point out, which compensates for incomplete contracts and an imperfect rule of law¨ (p. 348). In this way, BGs fill institutional gaps through their internal market and make a set of valuable resources and capabilities available to GAF companies (Holmes et al., 2018; Khanna and Rivkin 2001; Khanna and Yafeh, 2007). ; Mahmood et al., 2011).) ¨that would not otherwise be available through arm's length contracts¨ (Carney, Van Essen, Estrin and Shapiro, 2017, p. 59).

However, it is not feasible to identify the direct relationship between the GAF and the BG in terms of innovation, since the literature deals with studies aimed at heterogeneity, obstacles and factors that influence the development of innovation processes in the BG, associated with excessively expensive processes, financial limitations and little potential for success in the market, it is essential to highlight the importance of this study, since the literature lacks a systematic analysis that empirically compares the effect of obstacles for companies of different sizes; sectors and markets, making it necessary to highlight the literary scarcity on the direct relationship that exists between the Obstacles, the economic Conglomerates and the capacity for innovation; which makes it difficult to base the hypothesis, however, and based on the results of the model, it is important to highlight that the three variables are directly related and that the capacity for innovation depends on the obstacles presented by the conglomerates.

Conclusion

This document explores the role of conglomerates in the innovative performance of companies in the manufacturing industry and the service sector in Colombia. The results indicate that the composite conglomerates facilitate the complete mechanism of innovative performance, although they are more likely to generate adverse effects on process innovations in the manufacturing sector and positive effects on product innovations generated by the services sector.

In terms of the interaction between the obstacles and belonging to a conglomerate, the interactions are favorable: the interaction between the conglomerates and the cooperation obstacles in total, product and process innovations, and the interaction between the conglomerates and the regulatory obstacles that They operate in the service sector. In the manufacturing sector, the positive effects of interactions between clusters and knowledge barriers on organizational innovations, interactions between clusters and demand barriers on process innovations, and interactions between clusters and barriers are highlighted. of regulations on product innovations.

In short, conglomerates are important for innovative performance, but they have a purpose in mitigating the obstacles of cooperation and regulation of the elements that stimulate innovative performance.

The literature suggests that selection bias and endogeneity prevail in the relationship between obstacles and innovation; a result that discourages companies from innovating when too costly processes are created, due to financial limitations and little or no potential market success.

We believe that these contributions make this study interesting for the science and technology policy literature. In addition, it may be relevant for the design of innovation policies that provide information that allows for improving the design of policy instruments, especially for SMEs.

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