

MODEL PROPOSAL TO OPTIMIZE EFFORTS AND IMPROVE THE POSITION IN THE RANKING “DOING BUSINESS”

JUAN BOGGIO

jboggio@ucaribe.edu.mx

*Universidad del Caribe, Departamento de Economía y Negocios
Esq. Fraccionamiento Tabachines, 77528 Cancún, Quintana Roo, México*

SERGIO LAGUNAS

slagunas@ucaribe.edu.mx

*Universidad del Caribe, Departamento de Economía y Negocios
Esq. Fraccionamiento Tabachines, 77528 Cancún, Quintana Roo, México*

ALBERTO ROMO

aromoherreraibar@wpi.edu

*Royal Melbourne Institute of Technology, Becario CONACyT en Master of Analytics
Melbourne, Victoria, Australia*

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RESUMEN: El objetivo general es estimar la probabilidad para que algún estado mexicano pueda mejorar su posición en el *Ranking Doing Business*. Después de seleccionar las variables con mayor significancia mediante pruebas de bondad y ajuste, se aplica el método de regresión logística por su característica binaria, interpretada para este estudio como cambio o no cambio de posición en el ranking en períodos distintos. Se estima la probabilidad para que un determinado estado de México mejore su posición. Se desarrollaron 28 ensayos, que permitieron conocer en qué condiciones de costo, tiempo y número de procedimientos se mejora la posición. Los resultados aportan elementos para proponer adecuaciones en las variables consideradas en el Ranking, discriminando cambios en aquellas con poca significancia.

Palabras claves: *Doing Business*, Creación de empresas, Probabilidad de mejora, Regresión logística.

ABSTRACT: The general objective is to estimate the probability for a Mexican state to improve its position in the *Doing Business* Ranking. After selecting the variables with a larger or more relevant significance in terms of goodness-and-fit tests, the logistic regression method is applied for its binary characteristic, interpreted for this study as a change or no change of position in the ranking throughout different periods. The probability is estimated for a certain state of Mexico to improve its position. Twenty-eight trials were developed, enabling to acknowledge in which conditions of cost, time and number of procedures there is an improvement in the position. The results provide elements to suggest or recommend adjustments in the variables considered in the Ranking, discriminating changes in those with less significance.

Keywords: *Doing Business*, Entrepreneurship, Binary probability model, Logistic regression.

1. Introduction

It is well known nowadays that an efficient market economy is characterized as one able to recognize the importance of having a legal and regulatory system that functions adequately. According to Acemoglu and Robinson (2012) the economic success of countries varies due to the differences between their institutions, the rules that influence the functioning of their economy, and the incentives that motivate their people. These economic institutions must offer safety for private property, an impartial legal system, and public services that provide equal footing, in which people can trade and sign contracts; as well as allowing the entrance of new companies and permitting each person to choose his or her own profession.

Economic growth, on the other hand, is built on a high level of private investing and a heightened entrepreneurial spirit. Both factors are able to develop, according to the neoclassical theory, when economic agents, in this case entrepreneurs, perceive a just appropriability. According to Rodrik (2011), low appropriability may appear because of two main causes: government flaws or market flaws. To resolve said flaws governments will work, on the first case, on the diminishing of micro and macroeconomic risks; and on the second case, on correcting information and coordination externalities.

It is also acknowledged that entrepreneurial activity positively impacts three of the main objectives of public policies, such as the creation of new jobs, economic growth and poverty reduction (Ahmad and Hoffman, 2007), and that entrepreneurship and the creation of new businesses is considered a crucial mechanism for economic development (Schumpeter, 1934; Wennekers and Thurik, 1999; Baumol, 2002; Van Stel, et al., 2005).

Recognizing the benefits shown by the entrepreneurial spirit that are manifested in the creation of businesses, employment and wealth, it is natural to wonder which are the factors that generate it, fix its terms, and distinguish its main characteristics. According to the Organization for Economic Co-operation and Development (OECD, 2009), entrepreneurial spirit has multiple causes, but these come close to a combination of three factors: opportunities, peoples' capability, and the resources that they have. Said factors are affected by two main aspects: the regulatory framework and the culture. The determinant factors are those that represent the context in which businesses are created. Most renowned theories credit these factors with being able to propel and promote entrepreneurial activity if they are favorable, or to halt and disincentivize it if they are unfavorable.

A poor hiring and regulatory environment can augment the cost of *Doing Business* and have undesirable effects on employment creation, economic growth, investment, productivity, and on the population's living standard. But how to measure or even conceptualize the differences in the business climate, according to Besley (2015), is far from being resolved. However, there are already studies that facilitate some specific indicators, which enable two key actions: to efficiently compare the indicators chosen throughout time across countries, and to update said data in a timely manner as they are modified by political reforms.

The study that Besley refers to is that of *Doing Business* from the World Bank, which was launched in 2002. It allows to measure the environment in which companies operate in countries around the world. This project collects quantitative data to compare the regulations that small and medium businesses face in every economy. It was published first in 2003 with five sets of indicators for 133 economies; nowadays it includes 11 sets of indicators for 189 economies. Every year the report includes a table in which every country is ranked according to its score in each indicator. Another remarkable aspect is the recognition and criticism that the project has received, there are countless stances for or against the study, which shows that the study does not go unnoticed, Besley comments:

The *Doing Business* project has become a major resource for academics, journalists, and policymakers. The project also enjoys a high public profile with close to ten million hits on its website each year, making it one of the most prominent knowledge products produced by the World Bank. When Narendra Modi was elected Prime Minister of India, he explicitly targeted achieving 50th place in the ranking as a benchmark for his administration—which would mean an improvement of almost 100 places compared to India's recent rankings (for example, Buerkle, 2015). In 2012 Russian President Vladimir Putin set the goal of improving its *Doing Business* ranking to twentieth by 2018 (as reported in Adelaja, 2012). Many countries are keen to promote their achievements in moving up the rankings in trying to attract investors, which is acknowledged

in government export promotion strategies. For example, the UK government mentions Peru's ranking of 43 on "ease of doing business" prominently in its assessment of its business climate (UK Trade & Investment, 2014). The project has passed from being a data source and research tool to playing a role in the political economy of development policy (2015, p. 99).

Additionally, the World Bank has subnational reports from *Doing Business* that capture the differences in commercial regulations and their application in various areas of a given same country. All the studied cities provide data on the feasibility of making business, with which they are classified, later on reforms are recommended to each city in order to improve the performance in each of the indicated areas. So far, subnational reports have compared 438 locations across 65 economies since 2005. For instance, in 2016 the report on Mexico was published, and on 2017 that of Colombia.

Having these studies, this work is concerned with analyzing the *Doing Business* Mexico (Banco Mundial, 2016), with the purpose of identifying the variables that show the greatest statistical significance on the indicator for a given state or region. On the other hand, a probabilistic model is built with the variables that display the greater significance to estimate the improvement or worsening of the position of Mexico's states. This way it will be possible for each of the subnational governments, along with the business sector, to make decisions with the aim to attain a better score in the ranking.

Logistic regression is applied since the function is basically a nonlinear regression, as seen with independent variables that are not necessarily related, for example, the cost of building permits with the number of startup licensing applications. Furthermore, there was a need for a binary factor, interpreted for this study as "position change or no position change", specifically comparing the year 2014 to 2012, from which the proposed model will allow to estimate the probability for a given state or region to improve its position on the *ranking*.

2. Literature Review

The *Doing Business* report was published in 2003 for the first time but the team that created it was formed three years earlier, while the World Development Report 2002: Building Institutions for Markets (World Bank, 2002) was being done. Simeon Djankov remembers that the focus on underscoring the importance of the institutions on the development was chosen by Joseph Stiglitz, who was the chief economist of the World Bank at the time. As a member of the team in charge of doing the chapters about institutions and companies, Djankov contacted Andrei Shleifer, whose writings about the legal origins and various aspects of the institutional evolution were generating interest. Shleifer contributed in several documents with the background information for the report about the world development, on the condition that said work would be later used as an opportunity to collect and analyze data sets about the institutions between countries. That is how *Doing Business* started.

The inspiration to realize *Doing Business* was double, on one side the previous investigations done by Shleifer and Djankov about the waste of talent and entrepreneurial resources as a result of excessive regulation on the centrally planned ex economies of the European east, and by the other hand, Hernando de Soto's (1989) book, "The Other Path", which illustrates the prohibitively high cost of establishing a business in Peru, thus denying economic opportunities to the poor people, and causing the development of the informal economy.

The team Djankov-Shleifer produced as an initial result the development of five sets of indicators about the institutions affecting the entrepreneurs and the living cycle of the businesses, and these results were subsequently published in a series of articles in academic journals. Among the most relevant ones together with its findings, this might be highlighted:

- *The Regulation of Entry* (Djankov, et al., 2002) finds out that a more expensive regulation is associated with higher levels of corruption, bigger size or informal economy; fewer executive restrictions and less political rights.
- *Courts* (Djankov, et al., 2003) discovers that in procedural formalism, the degree in which disputes are regulated is associated with a higher duration of disputes, less applicability and higher corruption.

- *Private Credit in 129 Countries* (Djankov, McLiesh, and Shleifer, 2007) discovers that the common law is associated with higher rights for the creditor, while the Roman law is associated with a higher incidence of the public record of credits. It is also noted that the increase of the rights of the creditors and the incidence of public registry is associated with a higher proportion of private credit to the GDP.
- *The Regulation of Labor* (Botero, et al., 2004) finds out that left governments are associated to stricter labor regulations and more generous social security systems. It also highlights that socialist countries, Scandinavians and those ruled by Roman law have much higher levels of labor regulation than those governed by the common law. A burdensome labor regulation is associated with a lesser participation of the economically active population on the work force, especially among the youngsters.
- *Debt Enforcement around the World* (Djankov, et al., 2008) proves that enforcing debt is highly inefficient around the world, but it tends to worsen in underdeveloped countries and in those where the Roman law is ruling. It also shows that the payment of debt is strongly correlated to the per capita income.
- *Trading on Time* (Djankov, Freund, and Pham, 2010) determines how the delays in time affect the international trade, for example, any additional day in which goods are delayed from the factory to the ship reduces the trade in 1%, and it has been detected that this has a relatively higher impact on the exportation of time sensitive goods such as agricultural or perishable goods.
- *The Effect of Corporate Taxes on Investment and Entrepreneurship* (Djankov, et al., 2010) demonstrates that a ten per cent raise in the effective corporate tax rate reduces the proportion of the aggregated investment to the GNP in two percentage points. The corporate tax rates are also negatively correlated with the growth and positively correlated with the size of informal economy. The results are consistent with the inclusion of controls for other tax rates, the quality of the tax administration, the confidence on property rights, the level of economic development, the legislation, inflation and the openness to global trade.
- *The Law and Economics of Self-Dealing* (Djankov, La Porta, Lopez-de-Silanes, and Shleifer, 2008) presents a new measure of legal protection in favor of minority shareholders against expropriation by the professional body of management of such company. It is especially useful to evaluate economies in which the managers have no restraint to their own ambition, as it happened in the Russian economy in the period following the privatization of the state enterprises.

The previous notes reflect the theoretical foundation upon which *Doing Business* was built, although some of them were published in the years following the first report in 2003 and some research areas were even incorporated over the years. It is worth to mention that some fields of study were eliminated from the aggregated indicator, such as the measurement of the labor regulation. It is not the focus of this work, however worth mentioning, that the *Doing Business* study has faced diverse harsh criticism. On the other hand, it is convenient to highlight the significance that the press and the public policy makers have awarded to *Doing Business* as a distinction on the ranking, to evaluate or to propose improvements to the institutional frameworks of the national economies.

Djankov (2016) says that the data collection started simultaneously on the five initial projects and is based on a review of the laws and regulations of each economy. It was intended that the institutional efficiency and quality measures were comparable among countries, which was achieved by collecting the data of a hypothetical company precisely defined, as well as the circumstances that such company was facing. The hypothetical case is a firm with at least 60 employees, which is located in the country's largest business city. It is a private, limited-liability company and does not operate in an export-processing zone or an industrial estate with special export or import privileges. It is 100 percent domestically owned, and exports constitute more than 10 percent of its sales.

It is useful to begin with a broad understanding of how the *Doing Business* project works. The data collection surveys law firms, with around 10,000 questionnaires being fielded across the participating countries. Data are collected in a questionnaire concerning 11 specific topics:

- *Starting a business*, it is a measure of procedures, time, cost and minimum capital required to start a new business.

- *Dealing with construction permits* it is a measure of the number of procedures, the time and cost needed to build a warehouse.
- *Obtaining electricity*, it is a measure of the procedures, time, and cost needed to obtain permanent electrical connections for the construction of a new warehouse.
- *Property registries* it is a measure of the procedures, time, and cost needed to register commercial real estate.
- *Obtaining credit* measures the degree in which the laws of guarantees and bankruptcies protect the rights of the borrowers and lenders, it also measures the exchange of credit information.
- *The protection of the investors* measures the extent of the responsibility of the director, and the ease with which minority shareholders can sue.
- *Tax payment* measures the amount of paid taxes, the annual hours spent preparing tax returns and the total tax paid as a part of the gross profit.
- *Commerce through the borders* it is a measure of the number of documents required and costs incurred in the export and import of goods.
- *Enforce contracts* it is a measure of the procedures, time, and cost needed to enforce a debt contract.
- *Resolving insolvency*, it is a measure of the time, cost, and the percentage recovery rate involved in the bankruptcy procedures.
- *Employing workers* is a measure of the ease with which workers can be hired or made redundant and the rigidity of working hours, although this index is no longer used in the aggregate rankings.

For each of the 11 dimensions in the data, an aggregate score is created by taking a simple unweighted average of the ranks of the underlying indicators, which leads to a cross-country ranking within each of the 11 topics. To obtain an overall *Doing Business* aggregate ranking, the report calculates a percentile for each country for ten of the topics (the Employing Workers category is excluded). These percentiles are aggregated to obtain the Ease of *Doing Business* ranking. These are the headline rankings that receive so much attention in media coverage.

The *Doing Business* report now also measures the distance from the frontier to gauge how far countries are from best practice. The benchmark for this exercise is the best performance observed on each *Doing Business* topic across all economies and years since 2005. The score lies on a scale between 0 and 100. A perfect score of 100 would require that the economy is on the frontier in every one of the 10 dimensions that go into the ranking. A 75, for example, implies that an economy is 25 percentage points away from the frontier.

Overall, according to Besley (2015), country rank in the *Doing Business* report tends to be strongly correlated with measures of development success, as well as with income per capita and with other standard measures of institutional quality, but this gives little insight into the direction of causation. Instead, this is likely to be an instance of what in Besley and Persson (2011) we have called "development clustering," the observed phenomenon that most dimensions of development move together. If the exercise is valuable for monitoring progress relative to using more standard measures of institutional quality and prosperity, it is because the specific indicators are worth exploring dimension-by-dimension.

The *Doing Business* project provides a unique perspective. But it is important for those who use the data to be familiar with how they are collected, rather than blindly downloading them and running regressions. The data are quite unique: there is no other comparable project in terms of scale or scope. Thus, the *Doing Business* report has the capacity to cast light on dimensions of policymaking that were not covered in previous datasets.

Moreover, according to Besley (2015) there is valuable contribution to democratic debate made by the *Doing Business* data, which can be downloaded and read by citizens and policymakers of any country who wish to know how their country performs and to question whether this performance is justified. More generally, the report can be thought of as tool of "yardstick competition" between governments: that is, citizens use information that is available through the media to hold their governments to account based on performance comparisons; for example, Besley and Case (1995) and Salmon (1987). After all, if the *Doing*

Business comparison is not useful in some cases, it can be always be set aside. No country or politician or citizen is obliged to take notice of it.

For the purpose of the following work Mexico's subnational data will be used, as published in "*Doing Business in México*" (Banco Mundial, 2016), which captures different dimensions of the business climate in the 32 Mexican states through four indicators; opening of a business, obtainment of construction permits, property registry and contract fulfillment. The information about Mexico retrieved from the World Bank website (World Bank, 2018), apart from offering the 2016 report, allows to observe the previous reports (2006, 2007, 2009, 2012 and 2014). It is also possible to access an Excel document that contains the necessary information to compare the results from the year 2012 to 2014, and an Excel simulator allows to observe the impact that the reforms have on the classification of a state, changing the values of the indicators of the state of interest. One must be cautious that the simulator, facilitated by the World Bank, is limited by the premise that the other states do not reform their legislation during the same period.

3. Methods

The main objective of this study is to estimate the probability (King and Zeng, 2001; Wasserman and Pattison, 1996) of a Mexican state to improve its current position in the *Doing Business* Ranking. Therefore, the response or dependent variable will be the comparison between the state's position on 2014 and that of 2012; a 1 will signify that the position improved and a 0¹ will mean that the position worsened or stayed the same. Consequently, the dependent variable will be binary, while the independent variables (Ai and Norton, 2003; Pregibon, 1981; Williams, 2006) are related to the number of procedures, time in days, and cost that are necessary to establish, initiate and fulfill contractual obligations.

It is expected to get a link function that guarantees that the probability of a change in ranking position is comprehended between 0 and 1. The logit type was chosen (Hausman and McFadden, 1984; Wen and Koppelman, 2001; Clavijo, 2013; Barreiro et al., 2004; Fiebig et al., 2010), better known as cumulative logistic distribution (Gupta and Kundu, 2010), which offers an estimate of probabilities for each independent or predictor variable, which are considered samples to obtain confidence perspectives.

A logit model is presented in the form,

$$\hat{y} = f(\beta_0 + \beta_1 x_1 + \dots + \beta_n x_n) + \epsilon \quad (1)$$

where f is the logistic function,

$$f(z) = \frac{\exp^z}{1+\exp^z} \quad (2)$$

Therefore, the binary probability logistic model is finally presented in the following form (Friedman et al., 2000; Cramer, 2002).

$$P(x) = \frac{\exp^{\beta_0 + \beta_1 x_1 + \dots + \beta_n x_n}}{1 + \exp^{\beta_0 + \beta_1 x_1 + \dots + \beta_n x_n}} \quad (3)$$

3.1. Model assessment according to ranking division

Considering the four divisions of the ranking which are: starting a business (E), construction permits (I), property registries (F) and contracts (C) as well as the three elements that conform them, represented by the number of procedures (γ), the necessary time in days (ω) and the percentage of the cost (δ), the model adjustment will be assessed, first for each division, enabling us to identify the significance through the p-value of each element (γ , ω , δ) an individually for each division ($P_{E\gamma}, P_{E\omega}, P_{E\delta}, P_{I\gamma}, P_{I\omega}, P_{I\delta}, P_{F\gamma}, P_{F\omega}, P_{F\delta}, P_{C\gamma}, P_{C\omega}, P_{C\delta}$).

¹ The original data is available at <http://espanol.doingbusiness.org/reports/subnational-reports/mexico>

The first assessment will intend to identify the number of states that improved their position on the ranking (K_1) and those which lowered their position or remained the same (K_0). The second assessment was concerned with obtaining the p-value for each of the independent variables ($P_\gamma, P_\omega, P_\delta$) with a significance of 0.10 also interpreted as 90% confidence for the relation; in every case in which the p-value obtained is greater than 0.10 it will be understood that there is relatively no statistically significant association.

Finally, critical decisors, known as goodness of fit tests, are estimated to identify the best model. These are consistent with the p-value for the standard deviation method (P_ϕ) which is determined by,

$$D = 2 \left[\ln \left(\frac{L_f}{L_c} \right) \right] \tag{4}$$

where L_f represents the log-likelihood for the entire model, while L_c represents the log-likelihood of the model with a subset of the terms of the entire model; the individual contribution to the deviation of the whole entire model is given by,

$$d_i^2 = 2 \left[y_i \ln \left(\frac{y_i}{\hat{\mu}_i} \right) - (m_i - y_i) \ln \left(\frac{m_i - y_i}{m_i - \hat{\mu}_i} \right) \right] \tag{5}$$

where y_i is the number of events per row, $\hat{\mu}_i$ the estimated median according to the rows, and finally m_i represents the number of trials with respect to the rows (Hosmer et al., 1997).

Pearson's goodness-of-fit test (P_ξ) was also estimated through a chi-squared test χ^2 gotten from the difference between observed and obtained values,

$$\chi_{n-p-1}^2 = \sum_{i=1}^n \frac{(y_i - \hat{\mu}_i)^2}{V(\hat{\mu}_i)} \tag{6}$$

where n represents the number of observations, p the model's degrees of freedom, y_i the response value for the factors with respect to the covariance, $\hat{\mu}_i$ the estimated median according to the rows (Hosmer et al., 1997). Both critical decisors P_ϕ and P_ξ follow the criteria that a bigger obtained result, far from 0,10 will be interpreted as the representation of a better adjustment and general acceptance of the model.

Table 1. Model and elements' evaluation according to Ranking Divisions

| Starting a Business (E) | Construction Permits (I) |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| $K_1=9$ | $K_1=9$ |
| $K_0=22$ | $K_0=22$ |
| $P_E = \frac{e^{5,73 - 0,751 E_\gamma + 0,0596 E_\omega - 0,227 E_\delta}}{1 + e^{5,73 - 0,751 E_\gamma + 0,0596 E_\omega - 0,227 E_\delta}}$ | $P_I = \frac{e^{-1,74 - 0,012 I_\gamma + 0,0214 I_\omega - 0,005 I_\delta}}{1 + e^{-1,74 - 0,012 I_\gamma + 0,0214 I_\omega - 0,005 I_\delta}}$ |
| $P_{E_\gamma} = 0,385$ | $P_{I_\gamma} = 0,953$ |
| $P_{E_\omega} = 0,340$ | $P_{I_\omega} = 0,279$ |
| $P_{E_\delta} = 0,018$ | $P_{I_\delta} = 0,450$ |
| $P_{E_\phi} = 0,256$ | $P_{I_\phi} = 0,126$ |
| $P_{E_\xi} = 0,209$ | $P_{I_\xi} = 0,270$ |

Source: Elaborated by the authors through Minitab 17@17.3.1

According to the previous table, the division to start a business (E) displayed that in the individual analysis of the variables a clear significance was found since $P_{E\delta} < 0,10$ which asserts that the cost is statistically significant to determine the ranking position.

The estimated values for the construction permits' division (I) did not show significance on the individual analysis of the variables, since in every case the result was $P_{\gamma,\omega,\delta} > 0,10$.

Table 2. Model and elements' evaluation according to Ranking Divisions

| Property Registries (F) | Contracts (C) |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| $K_1=9$ | $K_1=9$ |
| $K_0=22$ | $K_0=22$ |
| $P_F = \frac{e^{0,03 - 0,025F_\gamma + 0,047F_\omega - 0,660F_\delta}}{1 + e^{0,03 - 0,025F_\gamma + 0,047F_\omega - 0,660F_\delta}}$ | $P_C = \frac{e^{29,3 - 0,886C_\gamma - 0,003C_\omega + 0,149C_\delta}}{1 + e^{29,3 - 0,886C_\gamma - 0,003C_\omega + 0,149C_\delta}}$ |
| $P_{F_\gamma} = 0,912$ | $P_{C_\gamma} = 0,306$ |
| $P_{F_\omega} = 0,068$ | $P_{C_\omega} = 0,606$ |
| $P_{F_\delta} = 0,172$ | $P_{C_\delta} = 0,196$ |
| $P_{F_\varphi} = 0,197$ | $P_{C_\varphi} = 0,140$ |
| $P_{F_\xi} = 0,355$ | $P_{C_\xi} = 0,372$ |

Source: Elaborated by the authors through Minitab 17@17.3.1

For the property registries division (F) the individual analysis of the variables showed that only P_{F_w} was significant, for the other two elements there is no significance since $P_{F_{\gamma,\delta}} > 0,10$.

For the contracts division (C) the individual analysis of the variables showed that the closest case to the significance level was P_{C_δ} with 0,196 the other two elements are not close to significance since $P_{C_{\gamma,\omega}} > 0,10$.

It is worth noting that the global decisors on all the presented models could be accepted since every result surpassed the 0,10 level.

3.2. Assessment of a combined model with elements from three divisions

It is noteworthy that the individually evaluated models for each of the divisions cannot be considered conclusive since the p-value was not smaller than 0,10 in all cases. Also, contrarily, for the global tests, specifically those referring to the standard deviation (φ), in every case the critical value of 0,10 was surpassed, with the best result being $P_{E_\varphi} = 0,256$. Regarding Pearson's correlation (ξ) the critical value was also surpassed in every case, with the best result for this statistic being $P_{C_\xi} = 0,372$.

The previous situations suggest integrating a combined model, from the variables that resulted more significant individually and establishing whether or not this new model fits properly, taking into account two fundamental elements. The first one is that the resulting p-value is significant, meaning $P_M < 0,10$ and that the results for the global trials of this combined model prove more convenient than those found in the best cases of the individual trials by ranking division, that is to say, the standard deviation $P_{M_\varphi} > 0,256$ and the Pearson goodness-of-fit $P_{M_\xi} > 0,372$.

Therefore, the main hypothesis is presented as follows:

The combined binary model with elements from the three divisions of the ranking can be accepted as a predictor to obtain the probability that a given state will improve its position, as long as the following conditions are fulfilled

$$P_M < 0,10, \quad P_{M_\varphi} > 0,256, \quad P_{M_\xi} > 0,372.$$

To present this new case, the dependent variable (y) will be the condition of whether or not a state improved its position in 2014 with respect to the 2012 ranking. A value of 1 will signify that the position improved, and a 0 will mean that the position worsened or stayed the same.

The independent variables selected from the first models according to the p-value results will be the cost of starting a business $P_{E\delta} = 0,018$. As for the construction permits division, the time will be considered in days $P_{I\omega} = 0,126$, for the property registries division the time was also considered in days $P_{F\omega} = 0,068$, finally the cost under the contracts division $P_{C\delta} = 0,196$ was included.

In line with the considered assessments, the number of states that improved their position on the ranking is 9, while those that remained the same or worsened their position were 22. The resulting p-values placed in contrast with the criteria described in the previous paragraph were the following:

Table 3. Combined model evaluation (M)

$$\tilde{y} = \frac{e^{-0,12 - 0,310E\delta + 0,0141 I\omega + 0,0662 F\omega - 0,020C\delta}}{1 + e^{-0,12 - 0,310E\delta + 0,0141 I\omega + 0,0662 F\omega - 0,020C\delta}} \quad (11)$$

$P_M = 0,006$

$P_{M\phi} = 0,419$

$P_{M\xi} = 0,559$

Source: Elaborated by the authors through Minitab 17@17.3.1

Considering the results obtained from Table 3, the model should be accepted as it fulfills the three conditions necessary not to reject the research hypothesis. In other words, it is affirmed that the binary combined model can be used as a predictor to obtain the probability that a given state improves its position on the ranking.

3.3. Trials Application

Table 4. Obtainment of the probability of improvement for the five lowest ranked states through the Combined Model included in Table 3

| | Position registered in 2014 | Possibility of improving future position | Cost of starting a business | Time in construction permits | Time in property registries | Contracts' cost |
|---------------------|-----------------------------|------------------------------------------|-----------------------------|------------------------------|-----------------------------|-----------------|
| Distrito Federal | 32 | 60,07% | 19,7 | 82,0 | 74,0 | 31,0 |
| Morelos | 31 | 60,86% | 11,2 | 48,0 | 57,0 | 22,5 |
| Baja California | 30 | 60,22% | 7,9 | 79,0 | 12,0 | 32,9 |
| Guerrero | 29 | 60,02% | 1,3 | 60,0 | 5,0 | 13,9 |
| Baja California Sur | 28 | 60,69% | 26,6 | 77,0 | 22,0 | 27,4 |
| | | | 3,4 | 39,0 | 18,2 | 8,4 |
| | | | 12,7 | 126,0 | 30,0 | 29,4 |
| | | | 6,1 | 84,0 | 24,0 | 17,4 |
| | | | 12,3 | 82,0 | 45,0 | 33,3 |
| | | | 4,3 | 22,0 | 25,0 | 3,3 |

Source: Elaborated by the authors through Minitab 17@17.3.1

In order to illustrate the applicability of the model contained in Table 3, 28 trials with different values for the variables were carried out, with the objective of obtaining the probability that one of the states that occupied the last five positions in the ranking, could have a probability of 60% up of improving their position in the ranking. This is taking into account the position occupied in the year 2014, as well as the

conditions that were offered that same year regarding the variables of cost of starting a business $P_{E\delta}$, time in construction permits $P_{I\omega}$, time in property registries $P_{F\omega}$, and finally, cost under the division of contracts $P_{C\delta}$.

Subsequently, the probabilities are estimated again, but for the five states with the best performance in the ranking, from the state positioned in second place to that which attained the sixth.

Table 5. Obtainment of the probability of improvement for the five highest ranked states through the Combined Model included in

Table 3

| | Position registered in 2014 | Possibility of improving future position | Cost of starting a business | Time in construction permits | Time in property registries | Contracts' cost |
|-----------------|-----------------------------|------------------------------------------|-----------------------------|------------------------------|-----------------------------|-----------------|
| Aguascalientes | 2 | 40,18% | 15,5 1,5 | 36,0 2,4 | 11,0 2,6 | 20,6 1,0 |
| Guanajuato | 3 | 45,27% | 5,8 1,6 | 39,0 11,0 | 17,0 5,8 | 25,8 6,2 |
| San Luis Potosí | 4 | 49,50% | 10,6 5,8 | 37,0 9,0 | 39,0 27,8 | 23,2 3,6 |
| Chiapas | 5 | 50,76% | 11,5 3,1 | 35,0 7,0 | 28,0 16,8 | 24,0 4,4 |
| Campeche | 6 | 60,94% | 5,6 5,1 | 84,0 83,7 | 22,0 21,5 | 22,9 22,9 |

Source: Elaborated by the authors through Minitab 17@17.3.1

4. Discussion of Results

It must be emphasized that, in order to obtain the probabilities contained in Tables 4 and 5, 28 trials with different values in each variable were integrated, reducing them from the last useful scenario, in order for them to be more attractive to investors or businessmen and as such attain a better position on the list.

Observing the resulting values for the states that had the lowest positions located in Table 4, the probability from 60% up that they improve their position was obtained between the trails 12 (as happened for the state of Guerrero) and not further than trial 20 (which was the case of the state of Baja California Sur). A distinctive characteristic of these cases is that the adjustments that would have to be made to the variables in order to better their position are not as drastic as in the case of states with better rankings.

On the other hand, the estimates of probability of improvement for those states with the highest rankings in 2014 presented probabilities of 40.18% up, as in the case of Aguascalientes (second place in the ranking) and up to 60.94% in the case of Campeche (sixth place in the ranking), in these cases it was necessary to estimate 28 trials for Aguascalientes, Guanajuato, San Luis Potosi, and Chiapas.

In accordance with the above, there is evidence to state that when a state has a better position in the ranking there will need to be a greater effort made in order to improve it. This affirmation can be confirmed by observing in Table 4 the rows that pertain to the values in the variables that served as base for their position in the ranking in 2014, with respect to the values in the immediate next row, adjusted in each case, that show the conditions they need to offer in order to have a probability of 60% up so as to improve their position.

5. Conclusions

The formerly developed model allows to know which variables are worth modifying (reducing or improving) that according to probability could grant an improvement in the position of the state in the *Doing Business* ranking. Additionally, it provides with a guide to avoid making unnecessary efforts trying to change costs or times in variables of little significance; those which, despite being modified, one could not expect to improve the position in the *Doing Business* ranking.

Three groups of interest are favored with the model. First, the crafters of public policy, legislators, and managers of public administration will find where to center their effort in order to achieve results in the ranking. For example, it is an adequate tool to achieve the objectives of improving ranking position that were proposed in Russia (Adelaja, 2012) and India (Buerkle, 2015). Secondly, businessmen, through chambers and associations, have a tool to justify the choice of policies and areas of improvement that would be significant and leave a palpable result in ranking improvement. Finally, academics could evaluate or refute the research related to this subject.

The article sets an approach as opportunity for future collaborative efforts in which transversal studies of different latitudes be carried out.

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