

The Influence of Internationalization on Credit Ratings: an Analysis of Brazilian Companies

A Influência da Internacionalização na Classificação de Crédito: uma Análise de Empresas Brasileiras

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■ RESUMO

O objetivo do presente trabalho foi analisar a relação entre internacionalização e classificação de crédito de companhias brasileiras. Os dados foram obtidos de uma instituição bancária que periodicamente classifica seus correntistas de acordo com o risco. Foi construído um modelo probit ordenado. O modelo construído usou a classificação de risco como a variável dependente e variáveis financeiras foram usadas como preditoras. A variável de interesse, internacionalização, mensurada pelas exportações e importações, se mostraram estatisticamente significativa, e isso indica que companhias com atividades internacionais são mais propensas a ter uma melhor classificação em relação ao risco, isto é, elas oferecem menos risco às instituições bancárias em relação à obtenção de crédito bancário.

Palavras-Chave: Classificação de crédito; risco; internacionalização; modelo de escolhas ordenadas.

■ ABSTRACT

The objective of the present study was to analyze the relationship between internationalization and credit rating of Brazilian companies. The data were obtained from a banking institution that periodically rates its customers according to risk. An ordered probit model was constructed. The constructed model used the risk rating as the dependent variable and financial variables were used as predictors. The variable of interest, internationalization, measured by exports and imports, was statistically significant, indicating that companies with international activities are more likely to have a better risk rating, that is, they pose less risk to banking institutions in relation to obtaining bank credit.

Key-words: Credit rating; risk; internationalization; ordered choice models.

1 INTRODUÇÃO

During the past few decades, financial institutions, especially banks, have been better able to measure the risk that their corporate and non-corporate clients pose, mainly due to a greater wealth of information on the variables that affect agents, as well as their magnitudes and oscillations. This trend is due to the fact that the overall consensus of various agents has been formalized by the rules established by the Basel Committee, an agreement that Brazil has signed, and through it the country's central bank has implemented its rules and monitored its procedures which have been adopted by financial institutions in relation to credit risk.

The evaluation of risk is one of the most complex activities that agents face, because many elements that may potentially lead to losses are not conducive to objective evaluation, and involve an ample portion of subjectivity. This is due to the fact that all measurements of risk are naturally incomplete and imperfect.

Even in terms of objective elements, the measuring of risk is a complex activity, because its agents can deny or distort information about their behavior, leading to a classic problem of asymmetry of information. In addition, there is also the problem of moral hazard, which means that these agents are capable of increasing risks due to contractual relationships, such as insurance contracts, for example (AKERLOF, 1970).

Independent of the difficulties that underly the measurement of risk, it is expected that financial institutions incorporate as much information as possible into their measurement metrics. This means that in the corporate segment, these institutions should take into account the full range of activities performed by companies, including, when they exist, those of an international nature, such as exports, and the maintaining of commercial representation offices or even production units in foreign countries, for example.

The reasons for the internationalization of company activities are many and have been well clarified by the established body of theory. A systematic review can be found in the work of Rask *et al.* (2008), which emphasizes four theoretical areas: a) economic and institutional; b) learning; c) strategic competition and d) inter-organizational.

Within the international business literature, it is recognized that the internationalization of a company's activities, no matter what type, implies different risks and also risks of greater proportions to the extent that a company becomes more international, as the learning theory, also known as behavioral theory emphasizes (JOHANSON; VAHLNE, 1977; 2009). According to this theory, due to the fact that a company is not familiar with international markets and has few resources at hand, it becomes more international incrementally, with a temporal trajectory that minimizes the chances of losses. However, other internationalization theories ignore this risk factor and focus on strategies (BUCKLEY; CASSON, 1988; DUNNING, 2000), on international entrepreneurship (JOHANSON; VAHLNE, 2006; WELCH; WELCH, 2004) and the phenomenon of precocious and rapid internationalization, termed "born global" in the literature (CHETTY; CAMPBELL-HUNT, 2004).

The fact that a company becomes more international implies that it faces risks of a different nature than those it would face if it operated exclusively in the domestic market, and this implies that banking institutions should take this information into account when classifying the level of risk that the company poses to the bank. To better investigate the relationship between internationalization and the ratings attributed to companies, this study intends to evaluate the magnitude of internationalization's impact on credit ratings. The underlying hypothesis is that companies that become more international, even though they face specific risks from international markets, have a greater capacity to manage them, offering less risk to banks which implies that they should receive better credit risk ratings. This hypothesis is based on the perspective that the construction of a rating should not only be based on financial metrics, but rather a broader perspective of the business (STANDARD; POOR'S, 2014).

Unlike past decades when only mature companies reached international markets, nowadays, with information technologies, small and early-stage companies can already internationalize, the so-called born global companies (KNIGHT; CASVUGIL, 2004). And this phenomenon changes the risk condition because they have fewer resources and capabilities (PAUL; ROSADO-SERRANO, 2019).

This study contributes to the literature by showing the importance of other information beyond specifically financial data in determining a credit rating. The inclusion of other variables can increase the reliability of the models and the quality of the resulting ratings, which in turn, will minimize credit risks. In this manner, this study's contribution is theoretical as well as practical, academic and empirical.

The rest of this article beyond the introduction is divided into the following sections: Section 2 presents a theoretical review to support this work; Section 3 presents the methodological points that it employs; Section 4 presents its results, and Section 5 presents our conclusions.

2 THEORETICAL REVIEW

Due to the fact that this work proposes the construction of a bridge between two fully consolidated areas: ratings and international business, this section is divided into two parts. The first discusses the various factors related to the classification of credit risk. The second presents the fundamental points of the theory of the internationalization of companies, focusing on Uppsala's theory, which was pioneering in incorporating the idea of risk within the internationalization process.

2.1 The classification of credit risk

The idea of credit is related to the transfer of an asset, normally financial, from one agent to another for a period of time. At the end of this period, the debtor agent transfers the sum to the creditor with interest. Brito and Assaf Neto (2008, p.19) argue that credit is the "activity of placing a quantity of money at the disposition of the debtor in the form of a loan or financing, through the commitment to pay it back at a future date." However, the receiving of this credit by the agent who has granted it is uncertain, which can lead to losses. To minimize potential losses, it is important to know the agent's capacity to pay. And one of the ways to know this in a systematic fashion is to perform a credit rating.

The attribution of a credit rating, for individuals as well as companies, is a fundamental activity for

banking institutions (ALVES; MATIAS, 2014; LIVINGSTON, POON; ZHOU, 2018), because a rating gives them a greater ability to manage their own risk (KISER *et al.*, 2016). The rating is also one of the variables that defines the interest rate charged for loans within the logic that lower risk is rewarded with lower interest rates (DAMASCENO *et al.*, 2008). According to Balios *et al.* (2016), credit ratings appeared in the 19th century as a service which offered companies a competitive advantage. In addition, credit ratings are also seen as fundamental to sustainable economic growth (RAMOS; SIMÕES, 2012).

Credit ratings from the point of view of Chou and Cheng (2012), are also capable of transmitting private information about other agents in the financial markets, and thus help decrease the asymmetry of information which has a substantial presence in these markets (AN; CHAN, 2012). Ratings use agent classification tools to assign them to risk levels based on the information obtained about the client in terms of its payment behavior (GARCÍA *et al.*, 2017). In addition, in producing a systematic classification of scores, ratings use a synthetic index that gathers both private and public information.

Damasceno *et al.* (2008, p. 345) emphasize that "understanding what determines a credit rating is a very useful exercise in the construction of internal systems similar to those of the ratings agencies, as well as knowing what can influence the credit spread between debt securities."

The procedure of attributing credit ratings is nothing more than classifying agents by the level of risk that they pose, which is in agreement with the Basel Accord. The current governing legislation is Basel Accord III. The first accord in 1988, standardized minimum capital requirements. The second accord in 2004, broadened its scope to establish cooperation mechanisms between the central banks of various countries as well as other authorities. One advance in relation to the first accord was the incorporation of operational as well as market procedures related to credit risk (ALVES; MATIAS, 2014). In 2010, the third accord was agreed to, and it was gradually phased in beginning in 2013.

The main advance of the third accord in relation to the previous accord is the understanding of Capital Requirements, which were redefined to make sure

that institutions would not be capable of incurring the losses that some financial instruments have caused (BCB, 2017). Large banks and various other types of financial institutions have developed procedures to monitor the level of risk that their clients pose (generate). Arslan-Ayaydin and Karan (2009), for example, argue that credit derivatives have stimulated attempts to measure and control credit risk. In this way, objectively knowing and measuring credit risk is fundamental.

According to Maia (2010), the scale and breadth of the Basel III Accord is substantially greater, because, in addition to companies, it covers the relationship between governments and other sectors of the economy, other governments and families. Independent of the agent's nature, the author notes increase in the cost of credit, due to the costs of greater capital requirements.

Costa (2005, p. 27) emphasizes the broader character of the Basel Accord. According to this author, the accord "also contributes to the better regulation of this sector worldwide, and even though it was signed in 1988 and Brazil only adhered to the treaty in 1994, it has forced controlling institutions and bodies to be more efficient, establishing best practices in risk management, principles of corporate governance, compliance, money laundering, accounting, auditing and efficient payment systems."

From a practical perspective in terms of preparing credit ratings, there are external agencies which evaluate companies and attribute these ratings such as Standard; Poor's (S&P) and Moody's, for example, and also a growing body of internal rating procedures designed to measure and manage the credit risks that a given organization faces (DAMASCENO *et al.*, 2008). This offers quite a broad array of risk classification techniques and procedures.

From an academic point of view, the first credit rating study was made by Durand (1941), based on using the Fisher statistic to differentiate specific groups in a given population (GARCÍA *et al.*, 2017). In Durand's model, we can clearly see the combining of financial and non-financial variables, such as age, gender, employment duration, and profession, to verify which are the determinants of rating classifications.

Inspired by this pioneering model, there have been a great variety of studies that analyze the rating

classifications of companies and other organizations with the widest array of variables, data sources, contexts and objectives. To give an idea of their quantity and variety, we may note that these articles emphasize the relationship between rating classifications with the severity employed by agencies in relation to classified organizations (DAMASCENO *et al.*, 2008), the quality of the institutional environment (SHEN *et al.*, 2012), institutional changes (HUANG; SHEN, 2015), governance structures (DRISS *et al.*, 2016), the intensity of research and development (CHEN; KIESCHNICK, 2017), mergers and acquisitions (KARAMPATSAS *et al.*, 2014), and IPO share prices (AN; CHANG, 2012). These examples show the diversity of the factors that are explored within the context of rating classifications. However, it should also be noted that more general analyses are also employed to explain ratings, following the model of Durand's pioneering study. The work of Balios *et al.* (2016) is an outstanding example of this.

The methodologies used in these works are varied, but we can discern a preponderance of econometric models. The econometric procedures related to the construction of models that seek to understand or predict ratings, are many, but they usually follow accounting or market aspects. Given that the data related to ratings is of a cross-sectional and longitudinal nature, many authors employ econometric panel data for ordinal variables (given that the rating is ordinal), including Al-Sakka and Gwilym (2010) and Balios *et al.* (2016). Other approaches are also used, such as neural networks, for example (Abiyev, 2014).

It should be noted that models with qualitative dependent variables, notably probit and logit models, are often used, such as Driss *et al.* (2016), Bakhtiari (2017), Chou and Cheng (2012) and Buch, Koch; Koetter (2014). Since ratings make various classifications (AAA, AA, A, and so on) that behave in an ordered fashion, there are also a great number of works that employ ordered probit or logit models, such as the studies of Bellotti *et al.* (2011) and Balios *et al.* (2016). The difference between these two models is that the first is appropriate for dichotomous or binomial variables and the second is used for ordinal variables.

2.2 Internationalization

The internationalization of an organization consists of commercial or production activities performed in other countries. Despite the simple definition, the reasons for internationalization are broad and complex to the extent that there are a significant number of theoretical approaches to explain the existence of this phenomenon. The subject of internationalization is relatively old, and dates back to classic authors of economics, such as Smith and Ricardo. However, it was during the 1960s that theories began to appear to explain the reasons for internationalization among organizations. One that stands out is Vernon's product life cycle theory (1966). Other established theories have also been adapted to explain internationalization such as the transaction cost theory (REID, 1983).

Within this branch of economics, various contributions of Dunning stand out, in particular his eclectic paradigm approach (DUNNING, 1977), as well as Buckley and Casson (1998). But it was another theoretical stream of thought that incorporated the subjective dimension, the idea of the risk associated with internationalization. This stream of thought has been given various names, such as the behavioral theory, the Uppsala School, or even the Nordic School. The seminal works here were those of Johanson and Vahlne (1977; 2009).

In general, the behavioral theory of Johanson and Vahlne (1977) points out that a company when it begins the internationalization process has few resources, and has little knowledge of international rules and the particular characteristics of foreign markets. The sum of all of these elements implies an elevated level of risk for the company. To achieve its objectives and gain entry to international markets while minimizing risk, the theory recommends that the internationalization process be implemented incrementally, to risk few resources. As the company acquires knowledge it can broaden its internationalization and enter the markets of countries that are more distant culturally. It should be noted that these results are for non-financial companies, but there is also equally valid evidence for financial companies, particularly banks (BUCH, KOCH; KOETTER, 2014).

Currently much has been written about internationalization and risk. Tuzová *et al.* (2015) analyze the perception of risk in small and medium sized companies in several European nations. Fudalinski (2015) verifies how organizations manage risk during periods of heightened turbulence in international business. Kubícková and Toulová (2013) identify the risks in the internationalization process for small and medium sized firms in the Czech Republic. Buckley *et al.* (2017) analyze the reasons why companies exhibit heterogeneous responses to host country risks.

The works mentioned above present evidence that the subject of internationalization and risk has been thoroughly explored in the international business literature. And within this area, it is possible to find those who have analyzed credit risks for companies that have internationalized (GONENC; ARSLAN, 2003; ARSLAN; KARAN, 2009). The work of Arslan and Karan (2009), for example, indicates that the capital structure of domestic and foreign firms is different. In addition, they emphasize that domestic and international factors affect the levels of risk of companies in different ways. This occurs because markets are not fully integrated. The article also points out that geographically dispersed companies have a lower discount rate than those that are more concentrated. This shows that, in theory, international businesses, even though they face other levels of risk, have better rating classifications. However, it should be noted that empirical evidence supports the idea that companies that are entering markets face higher levels of risk and, to the extent that they adjust their operations in international markets, their risk tends to decrease (SAMII, ALIOUCHE; WRIGHT, 2008).

2.3 Internationalization and credit risk

Credit risk is a significant concern for companies that operate internationally, as it is compounded by several factors such as political, economic, and market risks. Several studies have been conducted to explore the relationship between credit risk and internationalization of companies.

According to a study by Li, Lin, and Liang (2020), companies' internationalization affects their credit risk by increasing the complexity of their operating environment and changing their business model. The

study found that companies that have high levels of internationalization are exposed to higher credit risks due to foreign exchange rate fluctuations, economic instability, and the difficulty in managing cross-border relationships with suppliers and customers

Another study by Rebolledo, Caro, and Alarcón (2019) found that the extent of internationalization influences the credit risk of companies in emerging markets. The study found that companies with higher levels of internationalization tend to have lower credit risk due to their ability to diversify their income sources and reduce their dependence on a single market.

Furthermore, a study by Tao, Xu, and Liu (2021) explored the impact of different forms of internationalization on credit risk. The study found that joint ventures and wholly-owned subsidiaries are associated with lower credit risk compared to international licensing agreements and exports. The study also found that the credit risk associated with internationalization is moderated by factors such as firm size, financial leverage, and industry characteristics.

3 METHODOLOGY

This is a descriptive study supported by quantitative methodology, with data that comes from secondary sources. Therefore, the researchers have

not had any type of influence on the obtaining of this data, only its organization in order to meet this study's needs, as well as its statistical treatment and the constructed economic model.

3.1 Data source

The data comes from a sample obtained from a banking institution in the domestic context, which offered us data just for the State of Paraná. This data is for companies that have directly administrated accounts, or in other words, accounts which have a manager indicated as the account's administrator. Data was initially obtained for 80,989 companies (units of observation) for the month of July 2017. However, there are a number of types of legal institutions which are not the focus of this work in this database, such as various governmental bodies. All those which are not directly related with business were removed from the sample. In this manner, units of observation classified as state capitals, metropolitan areas, municipalities, and federal, state and municipal governmental bodies were removed, as well as those which were not classified by the banking institution itself. The final sample consisted of 80,293 units of observation.

The available variables are associated with general information about these companies. A general listing of these variables appears in Text Table 1 below.

Text Table 1 List of Variables

Variable	Representation	Unit
Risk	Level of risk that the company poses to the bank	Ordinal – 5 categories (A signifies lesser risk, E signifies greater risk)
International	Importing or Exporting performed by the company	Dichotomous – Yes if the company exports and/or imports; No if not
Revenues	Gross Revenues	Current monetary units
Margin	Margin of the company's contribution to the bank	Current monetary units
Employees	Number of company employees	Units
Municipality	Municipality where the company is located	Nominal
Size	Segment in terms of size attributed by the banking institution	Ordinal
CNAE	National Economic Activity Classification	Nominal

Source: Prepared by the authors

3.2 Econometric Model

We have constructed our econometric model based on this study's assumptions and hypothesis, and it is represented by the following equation:

$$\text{Risk} = \alpha + \beta_1 \text{Internacional}_i + \beta_2 \text{Revenues} + \beta_3 \text{Margin}_i + \beta_4 \text{Employees} + e_i \quad (1)$$

In the equation, notice the presence of α and β_j , which are parameters that are obtained after the model's estimation. The term represents error, which follows the classic behavior of regression models: zero average, constant variance and the absence of any type of correlation. As discussed above, it is expected that the sign of coefficient β_1 , the one associated with the International variable, will be positive. This implies that the presence of international activities increases the probability that a company will have a superior risk classification.

It's important to stress that not all of the variables were included in the econometric model, such as CNAE (National Classification of Economic Activities), municipality and size. The first two are nominal variables and their inclusion would seriously compromise the degrees of freedom, making the estimation more problematic. And size is correlated with revenues as well as the number of employees, which also generates estimation problems, mainly in terms of multi-collinearity. It is also understood that the omission of these variables would not add any additional information that could explain the classification of risk.

3.3 Estimation

The Risk variable is ordinal and consists of five categories: A, B, C, D and E, in which A represents the highest rating and E the lowest. It's good to remember that since this variable is ordinal, we need to use appropriate econometric models (GREENE, 2003).

Discrete choice models for ordinal variables are an extension of discrete choice models. In these models,

$$y_i^* = X_i \beta + e_i \quad (2)$$

As is characteristic of these models, y^* is not observable, and assumes the behavior of a latent variable. In discrete choice models there are only two possibilities ($y = 0$ or $y = 1$, but in ordinal variable models there are J possibilities:

$$\begin{cases} y = 0 & \text{if } y^* \leq 0 \\ y = 0 & \text{if } 0 < y^* \leq \mu_1 \\ y = 0 & \text{if } \mu_1 < y^* \leq \mu_2 \\ \vdots & \\ y = J & \text{if } \mu_{J-1} < y^* \end{cases} \quad (3)$$

The parameters μ_j are unknown and will be estimated together with β_j . The model also assumes that the e_i error terms are normally distributed, in addition, that they are normalized, or in other words, their average is zero and their variance is one. This makes it possible to determine the following probabilities:

$$\begin{cases} \text{Prob}(y = 0 | x) = \Phi(-x' \beta) \\ \text{Prob}(y = 1 | x) = \Phi(\mu_1 - x' \beta) - \Phi(-x' \beta) \\ \text{Prob}(y = 1 | x) = \Phi(\mu_2 - x' \beta) \\ \vdots \\ \text{Prob}(y = 1 | x) = 1 - \Phi(\mu_{J-1} - x' \beta) \end{cases} \quad (4)$$

The function Φ can assume various probability distributions, and the most common are normal cumulative and logistic cumulative functions. Both are estimated through the maximum verisimilitude method (GREENE, 2003), or in other words, the estimates of the parameters are those values that maximize the probability of the effectively observed data. In the present work, both functions were employed, and we selected the one that generated better statistics according to Akaike's Information Criterion and McFadden's Pseudo R^2 .

Since we are dealing with a non-linear model, the interpretation of the parameters should not be performed directly with linear models, because the marginal effect of each of the independent variables in the model needs to be calculated. According to Mallick (2009), the marginal effect of x_1 for the J th response is given by:

$$\begin{aligned} \delta_{1,j} &= \frac{\partial \text{Prob}[y = j | x]}{\partial x_1} \\ &= [\Phi(k_{j-1} - \beta'x) - \Phi(k_j - \beta'x)]\beta_1 \end{aligned} \quad (5)$$

4 RESULTS

This section displays the study's results. First, we will present the overall data in terms of descriptive statistics. Next, we will present the results of the constructed econometric model. A brief discussion will follow.

Before discussing the results, it is important to highlight some aspects of the period covered by this research. The 2014 crisis had a significant impact on Brazilian companies' access to credit and their ability to internationalize. The country experienced a severe economic recession, which led to a credit crunch, making it more challenging for companies to secure financing. This situation forced many companies to reduce their investments, cut jobs, and even close their operations. However, as the country's economy has started to recover, there has been a gradual improvement in companies' access to credit. Brazilian companies are now looking to internationalize to diversify their revenue streams and reduce their reliance on the domestic market. The devaluation of the Brazilian currency also made the country's products more competitive in the international market, leading to increased export opportunities. Despite the challenges brought on by the 2014 crisis, Brazilian companies have continued to innovate and explore new opportunities for growth, including internationalization.

Table 1 lists the frequency of the data in its original form. It may be noted that there are almost 81 thousand observations divided into a wide variety of

business segments. It should be emphasized that this is the banking institution's classification and there is no correspondence between this and other classifications, especially those of official governmental bodies. Of the almost 81 thousand observations, we may note a clear concentration in micro-enterprises, which represent around 64% of the total. Small companies are also a very important sector, and they represent more than 28% of the sample.

As we can observe from Table 1, the sample has segments which are not compatible with the interest of this study, such as municipalities, state and federal entities and other entities which are of a public administration nature. All of them have been excluded from the sample, resulting in a sample of 80,293 observations.

Table 2 shows the frequency of internationalization, measured by the importance of imports and/or exports per segment. Initially we observe a low number of companies that have some type of involvement in international commerce, because just 195 of the totals have international activities. This value represents 0.24% of the total.

It is important to note that the segmentation presented is based on financial factors and not the company's activity. Thus, in this sample we find companies from a wide array of economic activities all within the same segment. It is also important to highlight that normally the companies that have some types of international business are industrial in nature along with a few involved in commerce or in supplying services. Banking institutions, in turn, work with any type of legal entity. This explains the small percentage of businesses which operate in other countries within this sample.

Table 3 displays frequencies in terms of these companies' risk classifications and internationalization. Initiating the analysis with the column that does not distinguish whether companies conduct international business or not (the last column), it may be noted that approximately 16% have an A classification, roughly 46% have a B classification, 16% have a C classification, a bit more than 2% have a D classification, and approximately 7% have an E classification. Almost 12% do not have any classification. The reasons that impede this classification by the banking institution were not provided to this

Table 1 Frequency of sample business segments

Segment	Absolute frequency	Relative frequency	Cumulative frequency
WAITING TO BE CLASSIFIED	1	0.00	0.00
CAPITALS AND METROPOLISES	1	0.00	0.00
MIDSIZE COMMERCE	1	0.00	0.00
CORPORATE	6	0.01	0.01
COMPANY	4,767	5.89	5.90
MIDSIZE COMPANIES	907	1.12	7.02
LARGE MIDSIZE COMPANIES	32	0.04	7.06
STATE	1	0.00	7.06
NATION	4	0.00	7.06
LARGE MUNICIPALITIES	8	0.01	7.07
SME: FROM 10 TO 20 MILLION	2	0.00	7.08
MICRO-ENTERPRISES	51,579	63.69	70.76
SME: FROM 1.2 TO 5 MILLION	1	0.00	70.76
SME: FROM 360 THOUS TO 1.2 MILLION	8	0.01	70.77
SME: FROM 5 TO 10 MILLION	1	0.00	70.77
SME: UP TO 244 THOUSAND	1	0.00	70.78
MIDSIZE MUNICIPALITIES	21	0.03	70.80
UNCLASSIFIED	1	0.00	70.80
SMALL COMPANIES	22,988	28.38	99.19
SMALL MUNICIPALITIES	287	0.35	99.54
UNCLASSIFIED LEGAL ENTITIES	1	0.00	99.54
LEGAL ENTITIES W/O SEGMENT PROFILE	371	0.46	100.00
Total	80,989	100.00	

Source: Prepared by the authors

Table 2 Presence or Absence of International Activity in the Business Segment

Segment	Import/Export		Total
	NO	YES	
MIDSIZE COMMERCE	1	0	1
CORPORATE	6	0	6
COMPANY	4,694	73	4,767
MIDSIZE BUSINESSES	889	18	907
LARGE MIDSIZE BUSINESSES	29	3	32
SME: FROM 10 TO 20 MILLION	2	0	2
MICRO-ENTERPRISES	51,573	6	51,579
SME: FROM 1.2 TO 5 MILLION	1	0	1
SME: FROM 360 THOUS TO 1 MILLION	8	0	8
SME: FROM 5 TO 10 MILLION	1	0	1
SME: UP TO 244 THOUSAND	1	0	1
SMALL COMPANIES	22,893	95	22,988
Total	80,098	195	80,293

Source: Prepared by the authors

Table 3 Frequencies of Risk Classifications and International Activities

Risk	Imports/Exports				Total	
	NO		YES			
A	12,938	16.15%	66	33.84%	13,004	16.19%
B	36,881	46.04%	88	45.12%	36,969	46.04%
C	12,967	16.18%	13	6.66%	12,980	16.16%
D	1,885	2.35%	4	2.05%	1,889	2.35%
E	5,915	7.38%	24	12.30%	5,939	7.39%
Not rated	9,512	11.87%	0	0	9,512	11.87%
Total	80,098	100%	195	100%	80,293	100%

Source: Prepared by the authors

study's authors and, therefore cannot be speculated or commented on here. In general, it may be noted that approximately 62% of the companies are classified as having higher ratings (A or B) and are therefore understood as posing less risk to the banking institution.

Distinguishing the companies that have international operations from the ones that do not, we may observe some significant differences in levels of risk. Of those that are international, 34% have an A classification, 45% a B classification, 7% a C classification, 2% a D classification, and 12% have an E classification. Of those which are not international, 16% have an A classification, 46% a B classification, 16% a C classification, 2% a D classification, and 7% an E classification. Among the companies with interna-

tional business, those classified as E outnumber those classified as C or D. This may be related to when they entered the market. As pointed out in the theoretical review, companies entering the market tend to have greater levels of risk that tend to diminish as they adjust their operations to the market.

Since the other independent variables included in the model are quantitative, we list their descriptive statistics in Table 4. As is expected, because of the varied reality of the companies associated with this banking institution, all of the variables present great variety which is also reflected in the standard deviation. Note that the contribution variable only presents negative values, or in other words, these are the losses that the banking institution is facing.

Table 4 Descriptive Statistics for the Revenue, Contribution and Employment Variables

Variable	Observations	Average	Standard Deviation	Minimum	Maximum
Revenues	80,293	2,139,767	1.04e+07	0	1.01e+09
Contribution	80,293	32.81415	15728.11	-2,645,338	501,299.4
Employees	80,293	6.734908	41.8418	0	6,000

Source: Prepared by the authors

Table 5 displays the correlations between the variables present in the econometric model. As is well known, the main diagonal exhibits the correlation of the variable with itself. Initially, it may be noted that all the other variables have a negative correlation with the risk variable, however, the values indicate a

low correlation or even absence of a correlation as is the case with the internationalization variable. The variables with the larger (positive) correlations were Revenues and Employees, however the values indicate a moderate correlation.

Table 5 Variable Correlations

Variable	Risk	Internationalization	Contribution	Employees	Revenues
Risk	1.0000				
Internationalization	-0.0156	1.0000			
Contribution	-0.2766	0.0385	1.0000		
Employees	-0.2151	0.0488	0.2620	1.0000	
Revenues	-0.2483	0.0700	0.3827	0.5914	1.0000

Source: Prepared by the authors

The result of the estimates for the parameters of the econometric model are presented in Table 6. Two models were estimated, the ordered probit and logit models. Both models are similar in conception; the difference between them is in the cumulative function utilized.

In the ordered probit model, the cumulative function is normal, while in the ordered logit model the cumulative function is logistic. The ordered probit model proved preferable to the ordered logit model for two reasons: a) it presented a smaller

Akaike Information Criterion and b) it generated a larger Pseudo R^2 value, giving it greater predictive capacity. As a result, all of the presented analyses and evaluations refer to the ordered probit model. As can be observed, all of the estimated parameters have statistical significance at least at a 1% level. Unlike other linear regressions, in which the value of the coefficient itself is interpreted directly, in the probit and other non-linear models, the interpretation is not direct, because it is necessary to calculate marginal probabilities, which appear in Table 6.

Table 6 Econometric Results – Ordered Probit Model

Variable	Ordered Probit Model		Ordered Logit Model	
	Coefficient	Standard Error	Coefficient	Standard Error
International	-0.2416343*** (-3.04)	0.0793669	-0.4214836*** (-2.89)	0.1456742
Gross Revenues	-7.38E-09*** (-15.17)	4.86E-10	-2.20E-08*** (-14.65)	1.50E-09
Marg. Contr.	-4.25E-06*** (-16.27)	2.61E-07	-0.0000119*** (-19.47)	6.11E-07
Employees	-0.0006759*** (-6.11)	0.0001107	-0.0025318*** (-7.07)	0.0003583
Cut 1 (μ_1)	-1.169113	0.0797569	-1.989013	0.146342
Cut 2 (μ_2)	0.2806251	0.0796593	0.4005843	0.1460757
Cut 3 (μ_3)	0.9639102	0.0797507	1.614838	0.1463235
Cut 4 (μ_4)	1.120238	0.0798009	1.921881	0.1464665
Pseudo R^2	0.1927		0.0045	
AIC	178,449.3		178,697.2	
BIC	178,552.6		178,770.5	

Source: Prepared by the authors

* denotes significance at least at a 10% level;

** denotes significance at least at a 5% level and

*** denotes significance at least at a 1% level

The cut values just below the estimated parameters is the various intercepts. In this methodology, the notation (Equation 3) is used to represent these intercepts. Note that it is possible to observe that there are four intercepts in ascending order, and this indicates that there are five categories of risk classification. It is not necessary to interpret these values, but for predictive purposes, which is another step of this work, they are necessary to complete the numerical equation.

Table 7 Marginal Effects (Probabilities)

Rating	A	B	C	D	E
International	6.39988	1.91127	-3.77522	-0.8377	-3.69823
Revenues	1.95E-07	5.84E-08	-1.15E-07	-2.56E-08	-1.13E-07
Contribution	1.13E-04	3.36E-05	-6.64E-05	-1.47E-05	-6.51E-05
Employees	0.0179	0.00535	-0.01056	-0.00234	-0.01035

Source: Prepared by the authors

Table 7 above displays the marginal effects which were obtained through the transformation of the coefficients presented in Table 6. Bearing in mind that all of the coefficients are statistically significant, the marginal effects, which can just as well be understood as probabilities, are also significant. From Table 7, we can state that a company that has international activities has a 6.39 percentage point greater chance of being in the A rating category than a company that does not have international operations. This figure is a 1.91 percentage point greater chance when we examine the B rating category. If it has a greater probability of being in these categories, it has a lesser probability of being in the other categories (the sum of all of the values for the same line should be zero). Having international operations implies a 3.77 percentage point less chance of being in the C rating category, a 0.83 percentage point less change of being in the D rating category, and a 3.6 percentage point less chance of being in the E rating category. Overall, it may be stated that a company with international activity will have an 8.31 percentage point greater chance of being better classified. It should be noted that the sum of all of the possibilities within the same line should be equal to zero, because if there is a greater probability of belonging to a given category, there will be a lesser

The fit of the regression can be observed from McFadden's Pseudo R^2 statistic. Once again, since the model in question is non-linear, the R^2 represented here requires a distinct interpretation of what is known as the determination coefficient in linear models. In the present instance, the values of between 0.2 and 0.3 express great fits. In Table 6, the second to the last line has a result of 0.1927, which indicates that the regression's fit can be understood to be quite good.

probability of belonging to another category. This is not a negative probability, but rather an expressive decrease in percentage point terms.

The interpretation for the other variables is similar, since they are not dichotomous, but rather quantitative. Taking the employees variable, for example, it indicates that larger companies have greater chances of obtaining better classifications. Thus, one more employee increases the chances of obtaining an A classification by 0.0179 percentage points, and increases the chances of obtaining a B classification by 0.00535 percentage points. If one hand, the increase in the number of employees increases its probability of obtaining a better classification, on the other, it diminishes its chances of being classified at lower levels, and this is why the other probabilities have a negative sign.

Table 8 displays the estimated predicted probabilities. Probabilities were estimated for each unit of observation belonging to a given rating category. The table's second column lists the absolute frequency, which is the same as Table 3 subtracting the not rated category. The third column corresponds to the relative frequencies which were observed directly.

The fourth column derives the estimated probabilities. With the values obtained for the parameters

Table 8 Observed and Estimated Probability Frequencies

	Observed absolute frequency	Observed relative frequency	Estimated probability (average)	Standard Deviation
A	13,004	18.37	0.1829	0.0260513
B	36,969	52.23	0.5228	0.013947
C	12,980	19.34	0.1834	0.0106416
D	1,889	2.67	0.0270	0.002175
E	5,939	8.39	0.0739	0.0136829

Source: Prepared by the authors

of each variable, it was possible to estimate the predicted values taking into account the data for each unit of observation. Through the predicted values, it was possible to find the average probabilities for each category, which are presented in the fourth column.

It may be noted that in Table 8 the probability values are quite close to their observed relative frequencies. This signifies that the constructed model has great explanatory capacity in terms of the classification of risk.

Based on the results listed here, the hypothesis that companies with international operations (imports and/or exports) have better risk classifications has been confirmed. Even though the model does not support this affirmation, it is possible to infer indirectly that international activity is one of the factors that contributes to a decrease in risk to banking institutions. This is due to the fact that any type of international operation, including imports and exports, requires a better level of company management in terms of production, marketing, finance and merchandising, especially in terms of foreign countries. In addition, any international activity needs to be in compliance with the procedures stipulated by the Treasury (Customs) and other governmental bodies involved with foreign trade, such as the Health and Commerce Departments, the Border Patrol and the Army, for example.

This set of market and legal operational procedures, even though it demands greater company resources, also gives a company a higher level of technical expertise, which is reflected in better business, economic results and more satisfactory finances. The sum of all of these elements contribute to a better positioning in relation to risk classification.

5 FINAL CONSIDERATIONS

The perspective employed in the present work is in harmony with that advocated by Standard and Poor's (2014) in the sense that risk classifications should have a broad perspective and should not only be focused on economic and financial elements. This is also in line with a considerable number of academic articles which cover a multiplicity of determinant factors in terms of risk (DAMASCENO *et al.*, 2008; AN; CHANG, 2012; SHEN *et al.*, 2012; KARAM-PATSAS *et al.*, 2014; HUANG; SHEN, 2015; CHEN; KIESCHNICK, 2017).

This study's findings are also in line with those pointed out by Gonenc and Arslan (2003), Arslan and Karan (2009), and Rebolledo, Caro, and Alarcón (2019). According to these authors, companies that also have to deal with international factors in addition to domestic ones, have different risk structures. Johanson and Vahle (1977; 2009) argue that internationalization leads to companies facing risks from other sources (foreign markets) and of other magnitudes. This requires these companies to be better prepared in terms of managing risk, which ends up reflecting directly or indirectly in all of their areas of operation, independent of whether they are in the domestic or foreign sphere.

Through this consistent sample with over 80 thousand units of observation, it has been demonstrated that companies with international business in terms of imports or exports have a greater chance of being classified as low credit risks, or in other words, they are classified favorably.

For companies that construct risk classifications for their clients, such as financial institutions

for example, knowing whether a company has international operations adds valuable information to the model making it more complete as well as more assertive. As is well known, risk is full of subjective components that are difficult to measure, but this is not the case with this information. As complex as it may seem, updated import and export information is freely disclosed by the Foreign Commerce Department, which is linked to the Ministry of Development, Industry and Foreign Commerce.

Unfortunately, the information contained in this database does not enable us to know whether the company, in addition to being an importer or exporter, deals with more complex international activities, such as foreign affiliates or production units. Future studies can add this information to these models, making them more realistic and giving them greater predictive accuracy. Another important piece of information would be to know the value of a company's international transactions or their weight in terms of its revenues, because we know that certain companies, independent of their size, have a large international presence, while others only export or import sporadically. Discriminating between these profiles would also improve the predictive capacity of the model. It should also be recognized that the data is highly disproportional in terms of the internationalization variable, because just 0.24% of the sample total have international activity. More proportional samples would make the model more robust.

On the other hand, one characteristic that should be emphasized in terms of this work is the database that it uses. First of all, because of its size with data for over 80 thousand companies, which is unusual in articles of this nature. Second, it comes from a banking institution, which has every interest in maintaining accurate information. These two characteristics make it possible to achieve results that are not very conventional within academia, but offer a wealth of detail.

Finally, it is important to note that the internationalization theory of Johanson and Vahlne (1977; 2009) emphasizes the aspect of learning, which gives a company greater capacity to manage risk in international as well as domestic markets. Therefore, it would be equally interesting to determine whether companies that have participated in international

markets for longer periods of time pose fewer risks and therefore have better credit ratings.

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