Credit Risk: A Company Account-Based Analysis

Juan Pablo Arango
Nancy Zamudio
Inés Orozco·

Introduction

Bankruptcy is a threat to financial stability, if a company fails to meet its financial obligations. Obviously, the risk to financial stability increases with the number of liquidated corporations and the size of the debt each has acquired. Moreover, in a scenario characterized by a significant number of liquidations, other corporations might experience financial difficulties that place additional pressure on the financial system. In these circumstances, there are obvious systemic risks that can lead to financial crisis and its usual consequences.

The extent of the potential risk to financial stability that comes from business failure depends on the likelihood of bankruptcy and the size of the debt at potential risk of default. This paper pretends to assess the various aggregate risks to financial stability. It uses company account data to construct a model for gauging the risks to financial stability posed by the corporate sector in Colombia. The objective is to analyze risks at the company level and their distribution.

Although some studies have been done on the reasons for insolvency in the Colombian corporate sector (Martínez, 2003), the findings of these works are clearly limited because of the time horizon, which rules out the possibility of including the impact of macroeconomic variables.

This article overcomes the difficulties found in previous works with respect to methodology and the data used to estimate the likelihood of bankruptcy. The exercise is based on a probit model for panel data (unbalanced). The panel includes an average of 8,481 corporations during the 1995-2004 period, with

· The authors work for the Financial Stability Department of the Monetary and Reserves Division at Banco de la República. The opinions expressed herein are their own and imply no commitment on the part of Banco de la República or its Board of Governors. Diego Vásquez's comments and technical support were much appreciated.

annual intervals. Specific variables of the corporations and the sectors were included in the panel, which was controlled, in turn, by macroeconomic variables.

Our study concentrates on the determinants of business failure. However, its primary objective is to construct a model to estimate the likelihood of a company going bankrupt, as a good way to assess the risks to financial stability. The findings are not substantially different from those of other international studies concerning the reasons why businesses fail (Bunn and Redwood, 2003 and Lennox, 1999).

Profitability and size appear to have a negative effect on the likelihood of bankruptcy, while the effect of financial leverage is positive. Also, the fact that a firm has foreign capital was found to have an additional impact. Ultimately, the results showed a negative relationship between the likelihood of corporate bankruptcy and improved macroeconomic conditions, even subsequent to control for individual characteristics at the company level.

In this study, we used estimates of the likelihood of bankruptcy to understand the distribution and concentration of the debt at risk of default. The goal was to identify where the risks are greatest. According to the findings, the debt at risk of default is concentrated in a relatively small number of corporations. However, they are not necessarily those with the highest likelihood of bankruptcy. This concentration underscores the importance of carefully monitoring firms with the highest risk of default. On the other hand, businesses that are most likely to fail are generally small and, as a result, carry no large debts on their books.

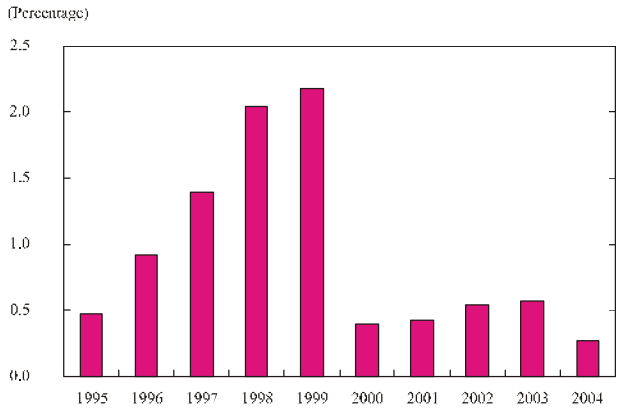
I. Stylized Facts

The crisis in Colombia at the end of the nineties was characterized, among many factors, by heavy corporate borrowing and reduced output. As a result, company balance sheets in the real sector showed a loss of income and profits. This slump during and after the crisis, coupled with the loss of access to credit markets, forced many corporations to liquidate. As illustrated in Graph 1, the number of business that failed during the period prior to the crisis rose sharply as of 1997. This may have sounded the alarm several years before the recession.

Law 550 was passed in December 1999 to respond to the crisis and to help businesses recover. It reduced

Graph 1

Liquidated Corporations



Source: Superintendency of Corporations.

the number of liquidated corporations considerably, largely because of the advantages that come with adhering to restructuring agreements of this type and to the terms that can be reached with creditors to pay off debts[1]. It should be noted that 2004, the final year of the period in question, saw the lowest percentage of liquidated corporations: just 25 (0.3%) of the 9,394 firms included in the exercises on debt at risk of default.

During each year of the 1995-2004 period, the liquidated corporations faced a very different situation than those that survived. The return on assets remained at around 3.5% for the corporations that survived, but was negative for those that did not[2] (Graph 2).

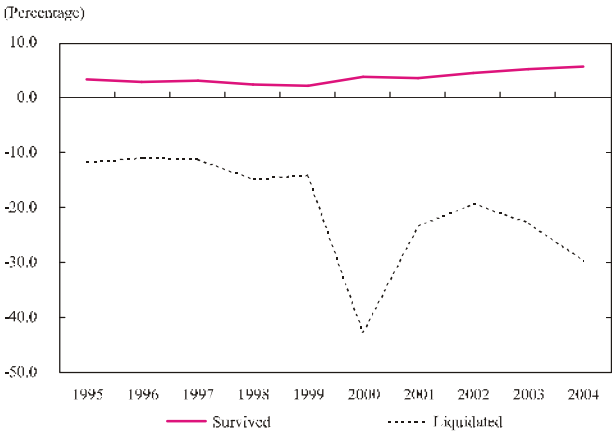
The failed businesses had less liquidity than the survivors. This is consistent with the idea that liquidated corporations experienced a major increase in liabilities, probably short-term. As a result, liquidity was reduced to 75%, on average, for the liquidated corporations, as opposed to 135% for the corporations that stayed in business.

Because of the sharp rise in corporate obligations to the financial system, coupled with a shortfall in cash flow, the failed businesses stopped paying their debts. This forced them into agreements with creditors to avoid bankruptcy and, after the crisis, into rescheduling agreements consistent with Law 550. However, many of these firms did not survive and were forced, by law, to liquidate. As shown in Graph 3, the indebtedness indicators (debt/equity ratios) of the liquidated corporations averaged 51% for the entire period; the highest ratio was in 2000 (170%).

This increase in borrowing by corporations that eventually failed can be explained by the growth in the domestic debt. When separating the domestic debt from the external debt, we found the debt to foreign lenders accounted for 7.4% of the assets of these businesses. The domestic debt accounted for a much higher proportion: over 100% in 2000 and nearly 80% in 2004.

GRAPH 2

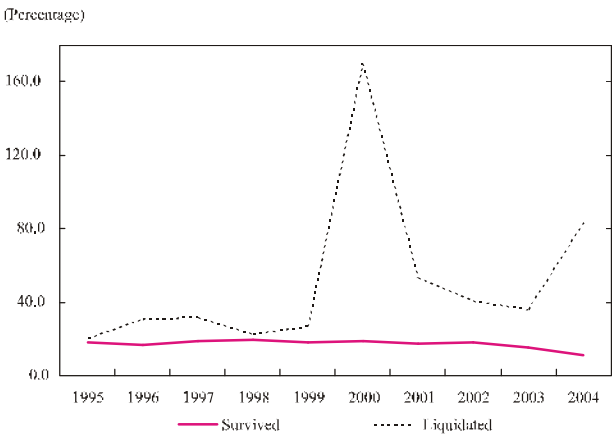
RETURN ON ASSETS



Source: The Superintendency of Corporations and Securities Superintendency.

GRAPH 3

INDEBTEDNESS



Source: The Superintendency of Corporations and the Securities Superintendency.

[1] Gómez and Zamudio (2004).

[2] The indicators for the liquidated corporations pertain to the data on corporations that went bankrupt each year.

In short, the situation facing the corporations that liquidated was one of high indebtedness and negative profitability. A look at the way the indebtedness indicator is distributed confirms this. On average, 23% of the corporations were not in debt and 39% had an indebtedness indicator somewhere between 5% and 30%. According to the distribution of return on assets, 35% of the corporations in Colombia showed a negative profit, on average, and 23% registered profitability in excess of 10%.

II. Data and Methodology

The empirical model selected for this study closely follows Bunn and Redwood (2003). The available information [3] constitutes a unbalanced panel for a ten-year period with 16,301 individuals. The information is annual. To calculate the likelihood of business failure, a probit model with random effects was estimated for the panel data. Specific variables for corporations and sectors were included, as were macroeconomic variables.

Profitability was one of the microeconomic variables monitored, assuming the lesser the profitability the greater on the likelihood of corporate bankruptcy. Indebtedness, liquidity and foreign investment indicators were included as well.[4] To capture the possible effect of belonging to a particular sector of the economy, dummy variables were constructed for each of the leading sectors, and real annual GDP growth was used as an indicator of economic activity.

The following is the estimated model:

$$Liquidation_{it} = f\,(Company\ var_{it}, dummy\ sector_{i}, \Delta GDP_{t})$$

Here, $Liquidation_{it}$ is a dummy variable equal to 1, if company *i* was liquidated during period *t*. The $Company\ var_{it}$ include the microeconomic variables described earlier, which are specific to each company during each time period. The dummy sector is a set of dummy variables equal to 1, if company *i* belongs to sector *j*, and 0 if otherwise.

III. The Results

Table 1 contains the result of the estimate. As expected, the corporations with negative profitability indicators, as opposed to indicators above 10%, have a positive coefficient. This denotes a greater likelihood of expected bankruptcy.

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[3] The data used in this study coincide with what the corporations reported to the Superintendencies of Corporations and Securities.

[4] See Attachment A for details on the variables used in this study.

The dummy profitability coefficient (between 0% and 10%) also is positive. Both coefficients are significant.

According to the indebtedness indicators (debt/equity ratios), the higher the domestic and external debt, the greater the likelihood that corporations will go bankrupt. However, the coefficient of the external borrowing variable is not significant. Also included in the estimate is an interaction variable that captures the effect of negative profitability and indebtedness over 20%. This interaction term is positive and significant.

The liquidity indicator is not statistically different from zero, nor is it significant. This is due primarily to its stability for most of the corporations during the period in question. Therefore, it is not considered a fundamental determinant in their liquidation. Although this indicator for the liquidated corporations was well below what it was for the survivors, its decline was not considerable.

The size indicator coefficient also met our expectations and is significant. It shows the largest corporations are less likely to go bankrupt than the smallest.

TABLE 1

PROBIT WITH RANDOM EFFECTS

Liquidation	Coefficient	Standard Error
D Profitability 1	**0.556** ***	0.06031
D Profitability 4	**0.137** **	0.06149
Domestic indebtedness/assets	**0.035** ***	0.01292
External indebtedness/assets	0.056	0.04407
D Profitability and indebtedness	**0.437** ***	0.03642
Liquidity	0.000	0.00000
Size	**-0.081** ***	0.00740
D Foreign investment	-0.069	0.04979
D Profitability and foreign investment	**-0.195** *	0.10736
D Agriculture	**-0.213** ***	0.06064
D Mining	0.065	0.11286
D Construction	-0.038	0.04862
D Commerce	0.004	0.04027
D Services	**-0.252** ***	0.04665
D Transport and communication	**-0.314** ***	0.08728
Δ GDP	**-0.063** ***	0.00477
Constant	**-1.472** ***	0.12837
Observations	84808	
Individuals	16301	
Log likelihood	-3829.2285	
Wald chi2(16)	1048.49	
Prob > chi2	0	
lnsig2u	-14	
Sigma_u	0.0009119	

* 90% significant
** 95% significant
*** 99% significant
Source: Calculations done by the authors.

Two variables were included to determine the effect that foreign investment has on a company. One was a dummy variable equal to 1, if more than 10% of company *i* is comprised of foreign capital[5] and 0 if not. The other was an interaction term that correlates two factors: negative profitability and being a foreign branch. The first variable shows the expected indicator, but is not significant. The interaction term is significant and shows the combination of negative profitability (which would imply greater estimated likelihood of bankruptcy) and being a branch (less estimated likelihood of bankruptcy) translates into less likelihood of bankruptcy. This suggests that head offices support their branches when they are in trouble.

Mining and commerce are the only major economic sectors where the likelihood of business failure is greater compared to corporations in the industrial sector. However, the coefficients for these variables are not statistically significant. On the other hand, the expected likelihood of bankruptcy is less for corporations in the agricultural, service and transportation, and communication sectors than for corporations in the industrial sector. The sample of corporations used in this study is biased towards the industrial sector; during the period in question, it accounted for 26% of the total corporations, on average.

Finally, the indicator of economic activity shows the likelihood of expected bankruptcy is less when economic conditions are better.

IV. Domestic Debt at Risk and Implications for Financial Stability

The purpose of this exercise is to determine the credit risk to the financial system posed by the commercial portfolio. The idea is to calculate the domestic debt at risk in the private corporate sector as a proxy for the possible losses the system could face, given the likelihood of company bankruptcy and assuming that none of the portfolio is recovered.

A. Domestic Debt at Risk of Default

After using the exercise described in the previous section to estimate the likelihood of bankruptcy, the domestic debt at risk of default (DDR) was calculated for each year, by sector and size, for the total sample. The ex ante DDR 6 is calculated as:

$$DDR_t = \sum_{i=1}^{N} pq_i^* \; domestic\; debt_i,$$

[5] This percentage was determined pursuant to the international standard on balance of payments.

[6] The ex ante debt at risk is the potential loss to the financial system, given the likelihood of corpany bankruptcy and assuming the system recovers none of the portfoio.

Here, pq_i is the likelihood of bankruptcy predicted by the estimate for each company. The *domestic debt*$_i$ is each company's domestic debt.

The ex post DDR[7] is calculated in a similar way:

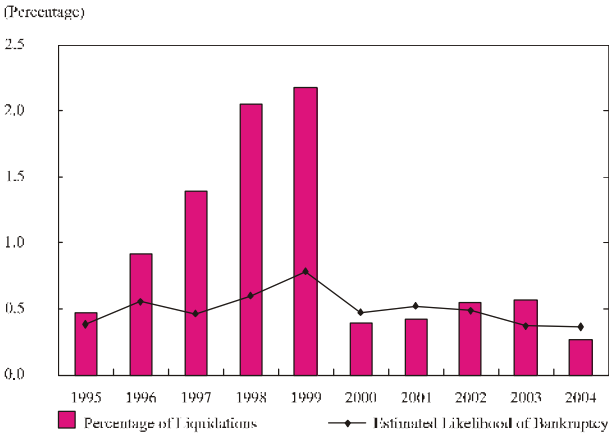
$$DDR\ ex\ post_i = \sum_{i=1}^{N} Liquidation_i^{*}\ domestic\ debt_i,$$

Here, $Liquidation_i$ is equal to 1, if company *i* went bankrupt in period *t*.

Our analysis included only the domestic debt at risk and not the external debt, as the former represents a direct danger to the financial system. Although corporations with foreign loans can pose a risk in the event of devaluation, they are not of interest to this exercise.

GRAPH 4

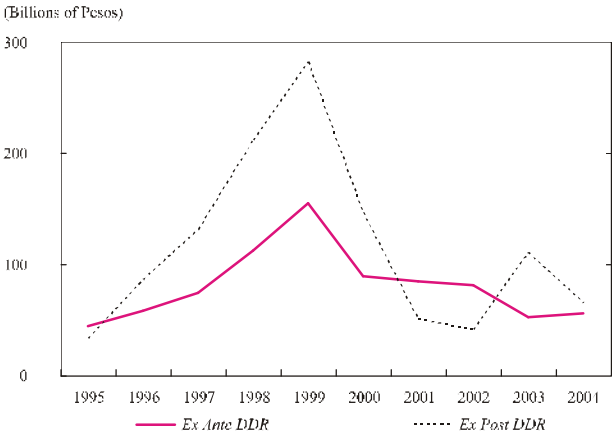
PERCENTAGE OF LIQUIDATED CORPORATIONS AND ESTIMATED LIKELIHOOD OF BANKRUPTCY



Source: Superintendency of Corporations. Calculations by Banco de la República.

GRAPH 5

EX ANTE AND EX POST DDR



Source: Calculations by Banco de la República.

B. The Results

A review of the corporations that actually went bankrupt during 1995-2004 shows the least number of liquidations occurred during the final year of that period. The most occurred during the crisis. Interestingly, the expansion in these liquidations began in 1997, two years before the recession (Graph 4).

The exercise shows the estimated likelihood of bankruptcy was lowest in 2004 and highest in 1999. The sectors with the lowest average likelihood of bankruptcy were transport/communications and services. Those with the highest likelihood were construction and mining. However, despite less likelihood of bankruptcy in the construction sector, it still had the highest indicator for the period analyzed.

Given the foregoing, the tendency in the ex ante DDR was similar to the tendency in the likelihood of bankruptcy (Graph 5). In 2004, the ex ante DDR for the corporations in total was equal to approximately 0.2%[8] of the commercial portfolio of the 5,000 largest private debtors[9].

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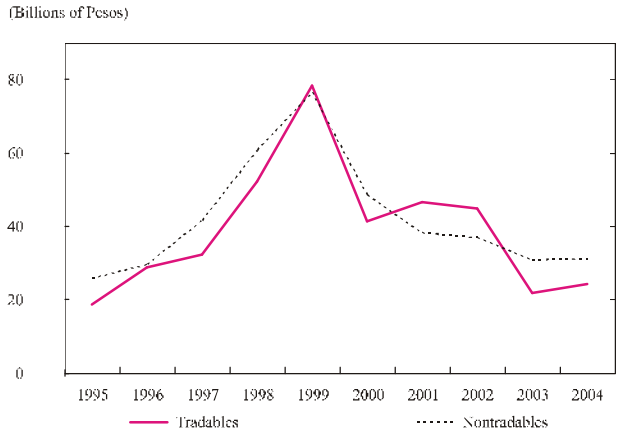
7 The ex post *debt is the loss actually incurred by the financial system if none of the portfolio is recovered.*

8 This is low compared to the percentage of commercial portfolio reserves, which was 3.8% at December 2004.

GRAPH 6

EX ANTE DDR FOR TRADABLES AND NONTRADABLES



Source: Calculations done by the authors.

TABLE 2

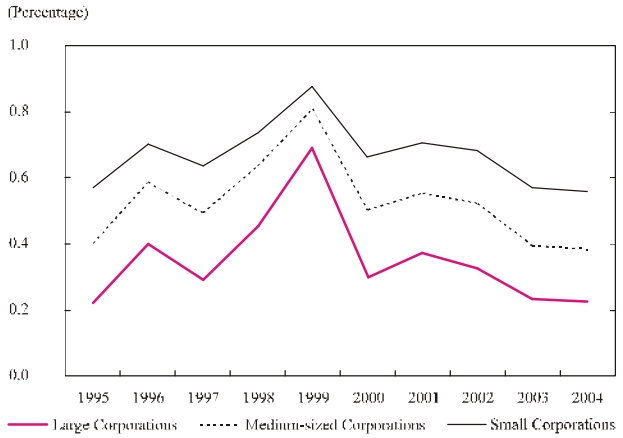
EX ANTE AND EX POST DDR AS A SHARE OF TOTAL DDR (PERCENTAGE)

2004	Ex Ante DDR	Ex Post DDR
Agriculture	5.74	3.75
Mining	1.78	0.00
Industry	36.34	12.02
Construction	12.19	2.16
Commerce	24.05	62.28
Services	16.81	16.72
Transport	3.10	3.07

Source: Calculations done by the authors.

GRAPH 7

ESTIMATED LIKELIHOOD ACCORDING TO SIZE



Source: Calculations done by the authors.

When dividing the sample between producers of tradables and nontradables,[10] we found the ex ante DDR of both groups behaved similarly to that of the corporations as a whole (Graph 6). Throughout most of the period in question, the ex ante DDR of the nontradables producers exceeded that of the corporations producing tradables, except in 2001-2002. This is because producers of tradables had a much larger domestic debt in those years, mainly due to increased borrowing by the mining sector. In the other years, the domestic debt is similar, but the likelihood of bankruptcy among corporations producing nontradables is greater.

Table 2 contains a breakdown of the ex ante DDR according to the major economic sectors. In 2004, the industrial sector accounted for the largest share of total DDR, while the mining and transport sectors had the smallest. As to the ex post DDR, the largest share pertained to the commercial sector, followed by the industrial sectors. The mining sector accounted for the smallest proportion, which was equal to zero.

When dividing the sample by size[11] we found the greatest likelihood of bankruptcy during the entire period was concentrated among the small corporations. It was the large corporations that showed the least likelihood of bankruptcy (Graph 7).

However, the large corporations account for 65% of the total DDR, as their indebtedness indicators (debt/equity ratios) are the highest. Because of their low indebtedness levels (debt/equity ratios), the small corporations have the least DDR, even though their estimated likelihood of bankruptcy is greater (Graph 8). This concentration underscores the importance of closely monitoring corporations that have the highest DDR levels. They pose the greatest risk to the

9 At December 2004, the commercial portfolio of the 5,000 largest debtors accounted for 72% of this portfolio as a whole.

10 This is the same classification used in the current edition of the Financial Stability Report, *specifically in the section on the private corporate sector*.

11 The sample was divided as follows: large (the 20% with the most sales), small (the 20% with the least sales) and medium (the remaining 60%).

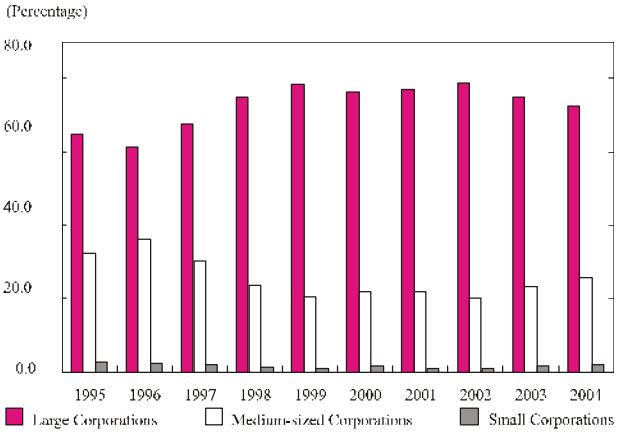
financial system in the event of shocks that could affect these firms in particular.

IV. Conclusions

Our study overcomes the difficulties encountered with previous works in terms of methodology and the set of data used to estimate the likelihood of business failure and its implications for financial stability. The large corporations account for the major share of the domestic debt at risk of default, while the small corporations, with their lower indebtedness levels (debt/equity ratios), are more likely to go bankrupt. Necessary efforts to monitor the private corporate sector can be targeted with this in mind.

Graph 8

DDR by Size as a Share of Total DDR



Source: Calculations done by the authors.

Today, the likelihood of business failure in the private corporate sector is close to the levels observed in 1995 (the lowest in the cycle). This fact, coupled with a better-quality commercial portfolio and less corporate borrowing from the financial system, means the credit risk posed by the commercial portfolio is not a latent threat to the stability of the financial system.

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Appendix

- Regression variable:
- *Profitability = Operational earnings/assets*
- *Size = Ln (Sales)*
- *Liquidity = Current assets/Current Liabilities*
- *Indebtedness = Financial liabilities /Assets*
- *Foreign investment = More than* 10% *foreign capital (only branches)*