**Figure 1: Distribution of sample observations by ratings**

**Figure 2: Distribution of sample observations by industry**

 **Table 1: Descriptive statistics of transformed and business profile variables**

This table presents summary statistics for three transformed financial ratios\* (interest coverage, debt coverage and leverage), size, profitability, liquidity, financial policy ratios and business profile variables (Bus-Seg-Aver and Geo-Seg-Aver) for the overall firms in our sample and according to rating categories. The sample period used is through 2008 to 2010 using a panel of 315 observations. Financial data are sourced directly from Thomson Reuters Datastream of the Worldscope Base. EBITDA interest coverage ratio is defined as the average of the EBITDA relative to Interests ratio. Debt coverage ratios are defined as the average of the free cash flow or the funds from operations relative to total debts ratios. Size ratios are defined as the average revenues and the average EBITDA. Profitability ratios are defined as the average of the return on equities and return on assets ratios. Liquidity ratios are defined as the average of the quick and current ratios. Financial policy is measured by the average of the total debts relative to common equity and the total debts relative to EBITDA ratios. Product and geographic diversification are measured by the average of the main activities and the average number of regions for which the company distributes its products

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean** | **Median** | **Standard Deviation** | **Minimum** | **Maximum** |
| * **Bus-Seg-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 3,773,423,313,072,923,20 | 3,533333 | 1,84651,89281,73221,58441,47711,6622 | 111111 | 988679 |
| * **Geo-Seg-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 3,23,6533,34,153,28 | 33333,53 | 2,45502,32981,96921,86752,84242,1469 | 111111 | 10101081010 |
| * **Rev-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 23780,5517091,9215845,613469,789539,31215986,41 | 18350,428767,658386057170,8336680,558847,533 | 19661,0219272,3219035,7817666,327500,07318740,55 | 1954,69700994,0731270,5370 | 7052873301,2378307,3475886,342939278307,34 |
| * **EBITDA-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B30verall | 2803,4622638,4382527,3682012,2631620,3072425,843 | 25861343,3331351,597112111101346 | 2108,0113018,663011,1551856,1971583,9632803,938 | -1117,667-1429,888-2494,667-443,666692,666-2494,667 | 1176311502,28419,3338569,6674975,66711763 |
| * **FFO/TD-Avera**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 0,55921,09241,0250,98420,59301,0122 | 0,40990,53520,50050,46070,27140,4864 | 0,56381,30191,49571,21611,07001,3503 | -10,05410,0386-0,02440,059-1 | 9,34395552,20379,3439 |
| * **FCF/TD-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 0,19970,67330,53630,47060,37530,5415 | 0,17950,30530,23590,24200,12380,2443 | 0,38531,20581,15750,93710,77011,1062 | -1-0,2464-1,7472-0,7046-0,2730-1,7472 | 1,09795552,80955 |
| * **EBITDA/INT-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 13,927220,195716,892320,665820,619718,5339 | 9,201912,35759,394410,50417,466410,541 | 12,777221,550121,018624,365332,793922,0101 | 000,09860,0018-0,3863-0,3863 | 51,112100100100100100 |
| * **ROA-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 8,38937,73567,03986,70485,47937,6643 | 7,95157,34867,17947,24186,28067,5203 | 6,60586,87265,70335,26387,13316,6301 | -6,7570-7,7016-14,0007-18,741-28,2035-28,2035 | 31,824633,525422,942421,082514,562633,5254 |
| * **ROE-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 19,171916,443015,871013,064212,430316,5243 | 18,548116,081215,236213,237913,522016,2041 | 16,877915,548414,115513,566515,663415,7590 | -25,7075-25,9676-30-31,9308-30-31,9308 | 77,130567,585154,63915044,817277,1305 |
| * **QUI Rat-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 1,16671,14831,03970,93550,93451,1060 | 0,97000,98580,91330,96810,65730,9549 | 0,79260,67110,69000,66080,47380,6983 | 0,31360,16110,06170,08720,08970,0617 | 4,38114,05223,74662,88242,38584,3811 |
| * **CUR Rat-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 1,89311,70421,63861,62181,40991,7114 | 1,60561,56671,40841,37771,29961,4759 | 0,99300,84810,93030,79760,62630,8941 | 0,83700,74940,34850,49280,26900,2690 | 7,16837,06765,17364,03152,55857,1683 |
| **Variables** | **Mean** | **Median** | **Standard Deviation** | **Minimum** | **Maximum** |
| * **TD/EBITDA-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overal**l** | 1,56021,77292,12042,26112,50432,0161 | 1,65831,57331,61822,25402,48721,5996 | 1,00061,33801,71382,13391,79381,6800 | 000000 | 3,745466,26598,560268,5602 |
| * **TD/CE-Aver**

Aaa-Aa1-Aa2-Aa3A1-A2-A3Baa1-Baa2-Baa3Ba1-Ba2-Ba3B1-B2-B3Overall | 61,040177,799682,474367,241782,937677,3939 | 53,423349,616861,612255,315959,894254,3800 | 38,976874,227272,961058,898087,792770,7937 | 1,169900000 | 141,2121271,357271271271271,357 |

 **Note: \*** Extreme values of interest coverage and debt coverage ratios are truncated. EBITDA interest coverage ratio is

 capped at a maximum of 100 and a minimum of 0. Debt coverage ratios are capped at a maximum of 5 and a

 minimum of (-1). Finally, negative leverage ratios are set to zero.

 **Table 2: Correlation matrix of Transformed and business profile variables**

This table presents correlations between each pair of variables of our model. We model the firm’s credit ratings as a function of its financial characteristics ; given by size, profitability, liquidity, debt coverage, interest coverage and financial policy; and of its profile given by product and geographic diversification. The sample period used is through 2008 to 2010 using a panel of 315 observations. Financial data are sourced directly from Thomson Reuters Datastream of the Worldscope Base. Financial ratios are measured considering a long-term perspective by using three-year averages of financial ratios rather than just the final recent year. We follow this process using data from 2006 to 2010. EBITDA interest coverage ratio is defined as the average of the EBITDA relative to Interest ratio. Debt coverage ratios are defined as the average of the free cash flow or the funds from operations relative to total debts ratios. Size ratios are defined as the average revenues and the average EBITDA. Profitability ratios are defined as the average of the return on equities and return on assets ratios. Liquidity ratios are defined as the average of the quick and current ratios. Financial policy is measured by the average of the total debts relative to common equity and the total debts relative to EBITDA ratios. Product and geographic diversification are measured by the average of the main activities and the average number of regions for which the company distributes its products**.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **EBITDA/INT-Aver** | **FCF/TD-Aver** | **FFO/TD-Aver** | **Rev-Aver** | **EBITDA-Aver** | **ROE-Aver** | **ROA-Aver** | **QUI RAT-Aver** | **CUR RAT-Aver** | **DE/EBITDA-Aver** | **TD/CE-Aver** | **Bus-Seg-Aver** |
| **EBITDA/INT-Aver** | 1 |  |  |  |  |  |  |  |  |  |  |  |
| **FCF/TD-Aver** | 0,60190,0000 | 1 |  |  |  |  |  |  |  |  |  |  |
| **FFO/TD-Aver** | 0,82060,0000 | 0,86090,0000 | 1 |  |  |  |  |  |  |  |  |  |
| **Rev-Aver** | 0,02860,4145 | -0,09350,0058 | -0,0880,0245 | 1 |  |  |  |  |  |  |  |  |
| **EBITDA-Aver** | 0,12550,0003 | -0,05210,1281 | -0,00500,8988 | 0,69730,0000 | 1 |  |  |  |  |  |  |  |
| **ROE-Aver** | 0,47860,0000 | 0,30580,0000 | 0,36980,0000 | -0,00820,8018 | 0,28170,0000 | 1 |  |  |  |  |  |  |
| **ROA-Aver** | 0,22580,0000 | 0,15070,0000 | 0,18970,0000 | 0,09440,0037 | 0,29700,0000 | 0,78030,0000 | 1 |  |  |  |  |  |
| **QUI RAT-Aver** | 0,37920,0000 | 0,35670,0000 | 0,38650,0000 | -0,28600,0000 | -0,14200,0000 | 0,18640,0000 | -0,04030,0379 | 1 |  |  |  |  |
| **CUR RAT-Aver** | 0,38630,0000 | 0,32820,0000 | 0,33270,0000 | -0,26500,0000 | -0,20530,0000 | 0,18300,0000 | -0,06860,2316 | 0,86670,0000 | 1 |  |  |  |
| **DE/EBITDA-Aver** | -0,57250,0000 | -0,38990,0000 | -0,45160,0000 | -0,08150,0183 | -0,08980,0094 | -0,48150,0000 | -0,28300,0000 | -0,30180,0000 | -0,33350,0000 | 1 |  |  |
| **TD/CE-Aver** | -0,45010,0000 | -0,36140,0000 | -0,46260,0000 | -0,01010,7576 | -0,01460,6609 | -0,21360,0000 | 0,10340,0015 | -0,32760,0000 | -0,33330,0000 | 0,63330,0000 | 1 |  |
| **Bus-Seg-Aver** | -0,10590,0026 | -0,08360,0138 | -0,13020,0009 | 0,21980,0000 | 0,24160,0000 | -0,11160,0006 | -0,05890,0709 | -0,11670,0005 | -0,09450,0043 | 0,07800,0244 | 0,09040,0058 | 1 |
| **Geo-Seg-Aver** | 0,20120,0000 | 0,07830,0221 | 0,10780,0064 | -0,01000,7604 | 0,13840,0000 | 0,17620,0000 | 0,12200,0002 | 0,17350,0000 | 0,17300,0000 | -0,12250,0004 | -0,10540,0014 | 0,15400,0000 |

 **Table 3: Univariate ordered probit model estimates of independent variables**

The ordered probit model is estimated separately for each of eleven financial variables and the two business profile variables (Bus-Seg-Aver and Geo-Seg-Aver). We model the firm’s credit ratings as a function of its financial characteristics; given by size, profitability, liquidity, debt coverage, interest coverage and financial policy; and of its profile given by product and geographic diversification. The sample period used is through 2008 to 2010 using a panel of 315 observations. Financial data are sourced directly from Thomson Reuters Datastream of the Worldscope Base. The parameters α1, α2, α3 and α4 partition the standard normal distribution into five regions, one for each credit rating class.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **α1** | **α2** | **α3** | **α4** | **β (Standard.Errors)** | **β x Standard Deviation** |
| **Bus-Seg-Aver** | -1,5980 | -0,6772 | 0,5533 | 1,7475 | 0,0318 (0,0215) | 0,0528 |
| **Geo-Seg-Aver** | -1,6797 | -0,7584 | 0,4641 | 1,6513 | 0,0041 (0,0165) | 0,0088 |
| **Rev-Aver** | -1,6027 | -0,6797 | 0,5692 | 1,7740 | 0,000007(0,000001)**a** | 0,1311 |
| **EBITDA-Aver** | -1,6113 | -0,6979 | 0,5549 | 1,7428 | 0,00004 (0,00001)**a** | 0,1121 |
| **FFO/TD-Aver** | -1,8189 | -0,8342 | 0,3735 | 1,5489 | -0,0116 (0,0315) | -0,0156 |
| **FCF/TD-Aver****D1****D2****D3****D4** | -1,8105-1,6966-1,7296-1,7191 | -0,8530-0,7516-0,7857-0,7732 | 0,40290,48750,45260,4667 | 1,60581,67911,64531,6579 | -0,538 (0,1246)**a**-0,0882 (0,1170)-0,0314 (0,0764)0,0967 (0,0925) | -0,16270,027940,01520,0387 |
| **EBITDA/INT-Aver****K1****K2****K3****K4** | -0,9073-1,4790-1,6193-1,6995 | 0,0078-0,5687-0,7141-0,7919 | 1,21810,63600,48070,4033 | 2,44791,86401,70241,6265 | 0,1682 (0,0413)**a**0,0610 (0,0179)**a**0,0135 (0,0087)**c**-0,0040 (0,0020) | 0,15430,13030,0588-0,0719 |
| **ROA-Aver** | -1,6286 | -0,7009 | 0,5377 | 1,7332 | 0,0107 (0,0053)**b** | 0,0709 |
| **ROE-Aver** | -1,6148 | -0,6659 | 0,5843 | 1,7854 | 0,0078 (0,0022)**a** | 0,1229 |
| **QUI Rat-Aver** | -1,6444 | -0,7125 | 0,5057 | 1,7467 | 0,0584 (0,0518) | 0,0407 |
| **CUR Rat-Aver** | -1,4976 | -0,5691 | 0,6600 | 1,9082 | 0,1165 (0,0398)**a** | 0,1041 |
| **TD/EBITDA-Aver** | -1,8969 | -1,0163 | 0,2399 | 1,4628 | -0,0853 (0,0224)**a** | -0,1433 |
| **TD/CE-Aver** | -1,7281 | -0,7953 | 0,4370 | 1,6337 | -0,00009 (0,0005) | -0,0063 |

 Note: a, b, c  indicate statistical significance at the 1%, 5% and 10% levels respectively.

**Table 4: The final ordered probit model**

This table presents results of the final ordered probit model retaining only eight variables: one of each of the pair variables reflecting size, profitability, liquidity, debt coverage and financial policy; interest coverage variable and the two profile variables given by product and geographic diversification. The model is estimated for the whole sample of 315 observations over the sample period 2008 to 2010. Financial data are sourced directly from Thomson Reuters Datastream of the Worldscope Base. K1, K2, K3 et K4 denote the coefficients associated with the increments of the ‘EBITDA/INT-Aver’ respectively in the ranges $[$0, 5), $[$5, 10), $[$10, 20) et $[$20, 100).L1, L2, L3 et L4 denote the coefficients associated with the increments of the ‘FCF/TD-Aver’ respectively in the ranges $[$-1, 0), $[$0, 1), $[$1, 3) et $[$3, 5) .

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Coefficient** | **Standard Error** | **p-value** |
| **EBITDA/INT-Aver** **K1****K2** **K3** **K4** | 0,19940,01720,0050-0,0090 | 0,0600,03410,01620,0034 | 0,0010,0130,0700,765 |
| **FCF/TD-Aver** **L1** **L2** **L3** **L4**  | -0,4604-0,4988-0,15540,0529 | 0,15810,22110,25010,2565 | 0,0380,0860,460,508 |
| **Bus-Seg-Aver** | 0,0048 | 0,0255 | 0,849 |
| **Geo-Seg-Aver** | 0,0057 | 0,0199 | 0,772 |
| **Rev-Aver** | 0,00011 | 0,000024 | 0,000 |
| **ROA-Aver** | 0,0131 | 0,0108 | 0,223 |
| **Cur-Rat-Aver** | 0,293 | 0,0662 | 0,000 |
| **TD/CE-Aver** | -0,0010 | 0,0007 | 0,029 |
| Where : LR chi2(14) = 83,58 Prob > chi2 = 0,0000Pseudo R2 = 0,0444Log likelihood = - 899,16235 |