**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-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 3,77  3,42  3,31  3,07  2,92  3,20 | 3,5  3  3  3  3  3 | 1,8465  1,8928  1,7322  1,5844  1,4771  1,6622 | 1  1  1  1  1  1 | 9  8  8  6  7  9 |
| * **Geo-Seg-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 3,2  3,65  3  3,3  4,15  3,28 | 3  3  3  3  3,5  3 | 2,4550  2,3298  1,9692  1,8675  2,8424  2,1469 | 1  1  1  1  1  1 | 10  10  10  8  10  10 |
| * **Rev-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 23780,55  17091,92  15845,6  13469,78  9539,312  15986,41 | 18350,42  8767,6583  8605  7170,833  6680,55  8847,533 | 19661,02  19272,32  19035,78  17666,32  7500,073  18740,55 | 1954,697  0  0  994,073  1270,537  0 | 70528  73301,23  78307,34  75886,34  29392  78307,34 |
| * **EBITDA-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  0verall | 2803,462  2638,438  2527,368  2012,263  1620,307  2425,843 | 2586  1343,333  1351,597  1121  1110  1346 | 2108,011  3018,66  3011,155  1856,197  1583,963  2803,938 | -1117,667  -1429,888  -2494,667  -443,666  692,666  -2494,667 | 11763  11502,2  8419,333  8569,667  4975,667  11763 |
| * **FFO/TD-Avera**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 0,5592  1,0924  1,025  0,9842  0,5930  1,0122 | 0,4099  0,5352  0,5005  0,4607  0,2714  0,4864 | 0,5638  1,3019  1,4957  1,2161  1,0700  1,3503 | -1  0,0541  0,0386  -0,0244  0,059  -1 | 9,3439  5  5  5  2,2037  9,3439 |
| * **FCF/TD-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 0,1997  0,6733  0,5363  0,4706  0,3753  0,5415 | 0,1795  0,3053  0,2359  0,2420  0,1238  0,2443 | 0,3853  1,2058  1,1575  0,9371  0,7701  1,1062 | -1  -0,2464  -1,7472  -0,7046  -0,2730  -1,7472 | 1,0979  5  5  5  2,8095  5 |
| * **EBITDA/INT-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 13,9272  20,1957  16,8923  20,6658  20,6197  18,5339 | 9,2019  12,3575  9,3944  10,5041  7,4664  10,541 | 12,7772  21,5501  21,0186  24,3653  32,7939  22,0101 | 0  0  0,0986  0,0018  -0,3863  -0,3863 | 51,112  100  100  100  100  100 |
| * **ROA-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 8,3893  7,7356  7,0398  6,7048  5,4793  7,6643 | 7,9515  7,3486  7,1794  7,2418  6,2806  7,5203 | 6,6058  6,8726  5,7033  5,2638  7,1331  6,6301 | -6,7570  -7,7016  -14,0007  -18,741  -28,2035  -28,2035 | 31,8246  33,5254  22,9424  21,0825  14,5626  33,5254 |
| * **ROE-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 19,1719  16,4430  15,8710  13,0642  12,4303  16,5243 | 18,5481  16,0812  15,2362  13,2379  13,5220  16,2041 | 16,8779  15,5484  14,1155  13,5665  15,6634  15,7590 | -25,7075  -25,9676  -30  -31,9308  -30  -31,9308 | 77,1305  67,5851  54,6391  50  44,8172  77,1305 |
| * **QUI Rat-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 1,1667  1,1483  1,0397  0,9355  0,9345  1,1060 | 0,9700  0,9858  0,9133  0,9681  0,6573  0,9549 | 0,7926  0,6711  0,6900  0,6608  0,4738  0,6983 | 0,3136  0,1611  0,0617  0,0872  0,0897  0,0617 | 4,3811  4,0522  3,7466  2,8824  2,3858  4,3811 |
| * **CUR Rat-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 1,8931  1,7042  1,6386  1,6218  1,4099  1,7114 | 1,6056  1,5667  1,4084  1,3777  1,2996  1,4759 | 0,9930  0,8481  0,9303  0,7976  0,6263  0,8941 | 0,8370  0,7494  0,3485  0,4928  0,2690  0,2690 | 7,1683  7,0676  5,1736  4,0315  2,5585  7,1683 |
| **Variables** | **Mean** | **Median** | **Standard Deviation** | **Minimum** | **Maximum** |
| * **TD/EBITDA-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overal**l** | 1,5602  1,7729  2,1204  2,2611  2,5043  2,0161 | 1,6583  1,5733  1,6182  2,2540  2,4872  1,5996 | 1,0006  1,3380  1,7138  2,1339  1,7938  1,6800 | 0  0  0  0  0  0 | 3,7454  6  6,2659  8,5602  6  8,5602 |
| * **TD/CE-Aver**   Aaa-Aa1-Aa2-Aa3  A1-A2-A3  Baa1-Baa2-Baa3  Ba1-Ba2-Ba3  B1-B2-B3  Overall | 61,0401  77,7996  82,4743  67,2417  82,9376  77,3939 | 53,4233  49,6168  61,6122  55,3159  59,8942  54,3800 | 38,9768  74,2272  72,9610  58,8980  87,7927  70,7937 | 1,1699  0  0  0  0  0 | 141,2121  271,357  271  271  271  271,357 |

**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** | 0,6019  0,0000 | 1 |  |  |  |  |  |  |  |  |  |  |
| **FFO/TD-Aver** | 0,8206  0,0000 | 0,8609  0,0000 | 1 |  |  |  |  |  |  |  |  |  |
| **Rev-Aver** | 0,0286  0,4145 | -0,0935  0,0058 | -0,088  0,0245 | 1 |  |  |  |  |  |  |  |  |
| **EBITDA-Aver** | 0,1255  0,0003 | -0,0521  0,1281 | -0,0050  0,8988 | 0,6973  0,0000 | 1 |  |  |  |  |  |  |  |
| **ROE-Aver** | 0,4786  0,0000 | 0,3058  0,0000 | 0,3698  0,0000 | -0,0082  0,8018 | 0,2817  0,0000 | 1 |  |  |  |  |  |  |
| **ROA-Aver** | 0,2258  0,0000 | 0,1507  0,0000 | 0,1897  0,0000 | 0,0944  0,0037 | 0,2970  0,0000 | 0,7803  0,0000 | 1 |  |  |  |  |  |
| **QUI RAT-Aver** | 0,3792  0,0000 | 0,3567  0,0000 | 0,3865  0,0000 | -0,2860  0,0000 | -0,1420  0,0000 | 0,1864  0,0000 | -0,0403  0,0379 | 1 |  |  |  |  |
| **CUR RAT-Aver** | 0,3863  0,0000 | 0,3282  0,0000 | 0,3327  0,0000 | -0,2650  0,0000 | -0,2053  0,0000 | 0,1830  0,0000 | -0,0686  0,2316 | 0,8667  0,0000 | 1 |  |  |  |
| **DE/EBITDA-Aver** | -0,5725  0,0000 | -0,3899  0,0000 | -0,4516  0,0000 | -0,0815  0,0183 | -0,0898  0,0094 | -0,4815  0,0000 | -0,2830  0,0000 | -0,3018  0,0000 | -0,3335  0,0000 | 1 |  |  |
| **TD/CE-Aver** | -0,4501  0,0000 | -0,3614  0,0000 | -0,4626  0,0000 | -0,0101  0,7576 | -0,0146  0,6609 | -0,2136  0,0000 | 0,1034  0,0015 | -0,3276  0,0000 | -0,3333  0,0000 | 0,6333  0,0000 | 1 |  |
| **Bus-Seg-Aver** | -0,1059  0,0026 | -0,0836  0,0138 | -0,1302  0,0009 | 0,2198  0,0000 | 0,2416  0,0000 | -0,1116  0,0006 | -0,0589  0,0709 | -0,1167  0,0005 | -0,0945  0,0043 | 0,0780  0,0244 | 0,0904  0,0058 | 1 |
| **Geo-Seg-Aver** | 0,2012  0,0000 | 0,0783  0,0221 | 0,1078  0,0064 | -0,0100  0,7604 | 0,1384  0,0000 | 0,1762  0,0000 | 0,1220  0,0002 | 0,1735  0,0000 | 0,1730  0,0000 | -0,1225  0,0004 | -0,1054  0,0014 | 0,1540  0,0000 |

**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 | 0,4029  0,4875  0,4526  0,4667 | 1,6058  1,6791  1,6453  1,6579 | -0,538 (0,1246)**a**  -0,0882 (0,1170)  -0,0314 (0,0764)  0,0967 (0,0925) | -0,1627  0,02794  0,0152  0,0387 |
| **EBITDA/INT-Aver**  **K1**  **K2**  **K3**  **K4** | -0,9073  -1,4790  -1,6193  -1,6995 | 0,0078  -0,5687  -0,7141  -0,7919 | 1,2181  0,6360  0,4807  0,4033 | 2,4479  1,8640  1,7024  1,6265 | 0,1682 (0,0413)**a**  0,0610 (0,0179)**a**  0,0135 (0,0087)**c**  -0,0040 (0,0020) | 0,1543  0,1303  0,0588  -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** | 0,1994  0,0172  0,0050  -0,0090 | 0,060  0,0341  0,0162  0,0034 | 0,001  0,013  0,070  0,765 |
| **FCF/TD-Aver**  **L1**  **L2**  **L3**  **L4** | -0,4604  -0,4988  -0,1554  0,0529 | 0,1581  0,2211  0,2501  0,2565 | 0,038  0,086  0,46  0,508 |
| **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 = 0,0000  Pseudo R2 = 0,0444  Log likelihood = - 899,16235 | | | |