Analysis Report

This report is structured as follows.

Contents

Descriptive Statistics

The tables below show descriptive statistics of the variables under study. Some variables are strongly kurtotic and skewed, which might be problematic to the residual assumptions of regression.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ipr	213	.000	1942.000	115.455	307.570	3.894	.167	16.469	.332
npa	213	.000	66.000	6.657	8.879	3.161	.167	14.252	.332
firmsize	213	240.000	721000.000	92213.601	133145.778	2.176	.167	4.646	.332
ebitdahead	213	-3.000	225.000	42.336	46.941	2.095	.167	4.250	.332
Firm Age	213	7.000	178.000	54.286	35.936	1.591	.167	2.051	.332
Valid N (listwise)	213								

The researcher suspected that the existence of outliers might be influencing the data distributions and these were inspected both from a multivariate and univariate perspective. A pragmatic approach to identify multivariate outliers is suggested by Hair et al. (2014): Mahalanobis distances. These are calculated for the variables to be entered on the multiple regression analysis and their results are divided by the number of variables. When sample sizes are large (100+), coefficients above 3.5 or 4.0 can be considered outliers (Hair et al., 2014). 14 cases showed Mahalanobis distances higher than 3.5 and were removed. The largest case was 13.042.

Next, univariate outliers were inspected for all the five variables of interest. The interquartile range was calculated for each variable and values outside the ± 3 times the interquartile range were considered extreme outliers and removed (Pallant, 2010). The following number of cases exceed these values for each variable:

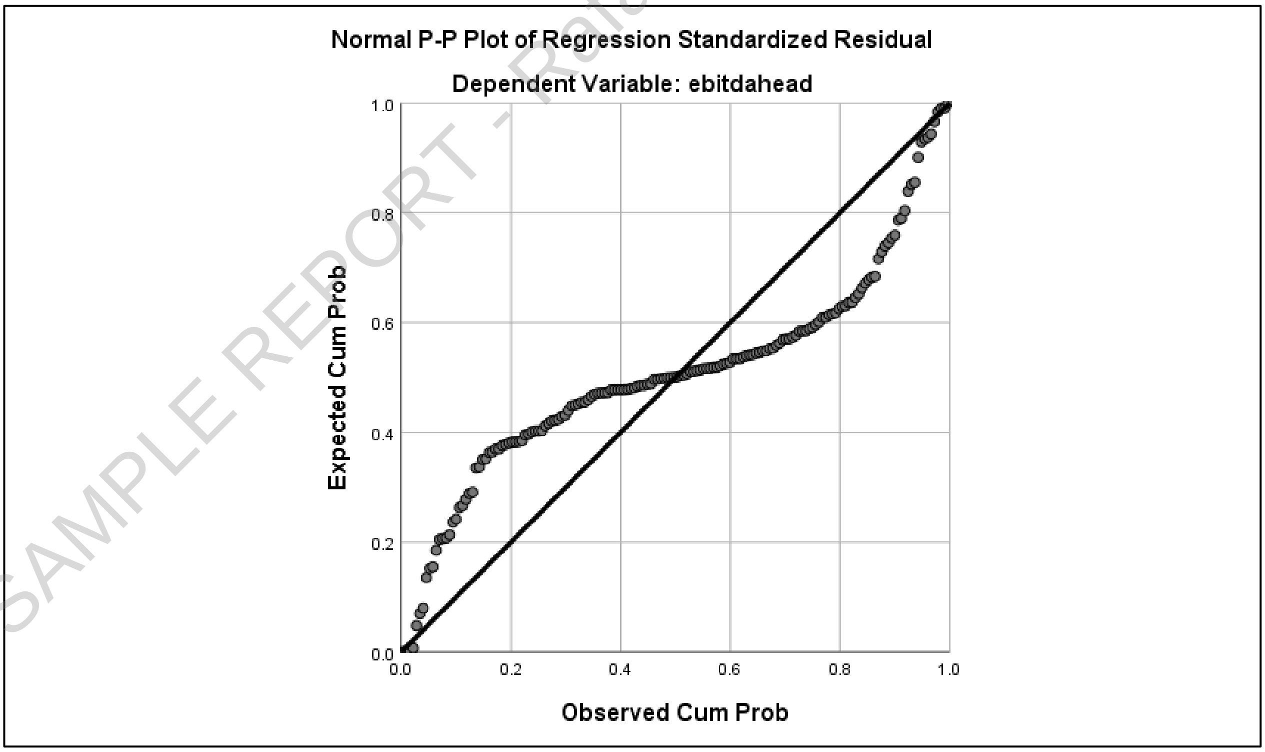
- IPR: 24 cases (values higher than 187);
- NPA: 4 cases (higher than 33);
- Firm Size: 17 cases (higher than 341,100);
- EBITDA/Head: 9 cases (higher than 162);
- Firm Age: 17 cases (older than 125 years).

The sample size was reduced from 213 to 166 cases. The Kurtosis and Skewness of the variables were reduced substantially, but were still high (table below).

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ipr	166	.000	184.000	22.295	28.419	2.396	.188	8.178	.375
npa	166	.000	25.000	4.946	5.142	1.551	.188	2.480	.375
firmsize	166	1563.000	330600.000	58222.633	77188.517	2.123	.188	3.696	.375
ebitdahead	166	-3.000	156.000	37.459	32.434	1.589	.188	2.061	.375
firmage	166	7.000	109.000	43.813	21.408	1.092	.188	1.704	.375
Valid N (listwise)	166								

Even with these potentially inappropriate data distributions, a regression model was executed to try to model the data. A dummy-variable regression model was used, which is an appropriate approach for grouped longitudinal data. The companies were recoded as dummy variables and these were inserted in the variable equation to eliminate the group effects. The model was not valid since the residuals were not homoscedastic and their distribution was not normal. The P-P plot of residuals is shown below. The dots are supposed to follow a diagonal pattern to indicate normality and this is clearly not the case.



A log-transformation of variables was attempted, without success. A linear mixed model with fixed effects was used instead, which does not require normality of residuals. The results are shown in the next section.

Linear Mixed Model with Fixed Effects

'Year' was included as Repeated variable and 'Company' was added as Subject variable. Compound symmetry was used as repeated covariance type. It assumes that all pairs of repeated measures have the same covariance, implying that the variances of each repeated measure are equal, and the correlations between any two repeated measures are equal.

The first model examined the effects of NPA, Firm Size and Firm Age on EBITDA, without the moderation variable. None of the variables showed significant effects ($p > 0.05$). If a 10% significance level is considered, then Firm Size shows a significant negative effect on EBITDA ($\beta = -0.158$, $p = 0.074$) (Table below).

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	.033	.162	29.941	.202	.841	-.299	.364
npa	.036	.058	150.954	.619	.537	-.079	.152
firmsize	-.158	.088	146.012	-1.797	.074	-.333	.016
firmage	.019	.164	30.093	.115	.909	-.315	.353

a. Dependent Variable: Zebitdahead.

A second model was executed including IPR as a predictor, which also did not show a significant effect on EBITDA ($\beta = -0.042$, $p = 0.483$). The table below shows the model coefficients.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	.037	.162	30.038	.227	.822	-.293	.367
firmsize	-.149	.090	152.793	-1.658	.099	-.326	.028
firmage	.025	.163	30.234	.153	.879	-.308	.358
npa	.039	.059	149.921	.659	.511	-.077	.154
ipr	-.042	.059	154.700	-.703	.483	-.159	.075

a. Dependent Variable: Zebitdahead.

Lastly, a model with the moderation term was inserted, to check if there is any moderation being applied by IPR on the relationship between NPA and EBITDA. No significant effect was observed on the multiplicative term (npa x ipr) ($\beta = -0.031$, $p = 0.454$), suggesting no moderation whatsoever.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	.046	.160	29.544	.286	.777	-.281	.372
firmsize	-.155	.090	150.360	-1.727	.086	-.332	.022
firmage	.030	.161	29.523	.185	.855	-.299	.359
npa	.055	.062	153.734	.887	.376	-.067	.177
ipr	-.034	.060	150.182	-.569	.570	-.154	.085
npa * ipr	-.031	.042	148.222	-.751	.454	-.113	.051

a. Dependent Variable: Zebitdahead.

References

Hair, J. F., Black, W., Babin, B., & Anderson, R. (2014). *Multivariate data analysis* (Seventh). Pearson Education, Inc.

Pallant, J. (2010). *SPSS Survival Manual* (4th ed.). McGraw-Hill.