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# Regression Tree-Based Segmentation of Enterprise Value: Bridging Machine Learning and Classical Financial Analysis

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**Abstract:** In this study, a novel hybrid analytical framework between the regression tree (RT) from machine learning and classical econometrics analysis is presented to understand the relationship between financial parameters and enterprise value (EV). Five predictors, which are: return on equity (ROE), debt-to-asset ratio (DAR), institutional ownership (IO), firm size, and firm age, were examined as independent variables. In particular, the algorithm was applied to split a dataset of 52 Indonesian consumer sector firms, dated from 2018 to 2023, where a linear regression model was assigned to each cluster of data. Based on the conducted numerical simulations, it was concluded that ROE and firm size had a consistently positive effect on the EV across all clusters. Meanwhile, the effect of IO, DAR, and age varied on each node. These findings suggest that the relation between financial parameters and firm value (FV) is not uniform and can be interpreted better by considering multi-segment data. This method serves as a new data-driven methodology to the traditional panel analysis, which is complex and requires significant knowledge in analytical statistics.
**Keywords:** Enterprise value, Firm value, Firm size, Machine learning, Regression tree

## 1. Introduction

Firm Value (FV) is considered the expectation of investors toward a firm which is materialized in the form of stock prices. FV is the current profit of all shareholders to be obtained in the future. Investors, in particular, before deciding to invest in a firm, will try to analyze the firm's performance. This performance is reflected in the capability of that firm to gain a return on equity (ROE), the capability of the firm to manage the resources, and the implementation of good corporate governance (GCG). Furthermore, this value also depends on the firm's size and the length of time the firm has been operating.

The influence of profitability, capital structure, firm size, and firm age on the firm value has been presented in numerous works, for example, in the research conducted by Susanti & Restiana (2018) and Lubis et al. (2017). A paper by Bhullar (2017) showed that profitability is negatively correlated with the enterprise value (EV) of pharmaceutical companies. Research by An et al. (2017) demonstrated that the EV can properly explain firm value by considering not only the capital market but also the duties that need to be paid.

Another research that aimed to study the influence of capital structure on FV was conducted by Saputra & Fachrurrozie (2015a), where they found that the capital structure correlated negatively with the FV. Meanwhile, research conducted by Asif and Aziz (2016), Hirdinis (2019), Yundari and Sedana (2020), Bui (2023), and Irawan (2022) showed that the capital structure correlated positively with the FV. Jhang et al. (2020), Lestari (2017), and Salehi (2022) have studied the influence of institutional ownership (IO) on FV. They have found that the IO correlated positively with the FV.

Another research conducted by Jhang et al. (2020) showed that equity ownership correlated negatively with the FV. On the contrary, the research done by Wu (2022) showed that while the IO affects the FV, ownership concentration does not affect this parameter. In Saputra dan Fachrurrozie (2015), research was conducted to understand the effect of firm size on FV. In their paper, it is shown that the firm size does not affect the FV. However, in the research conducted by Susanti and Restiana (2018), it was shown that the firm size correlated negatively with the EV, while Lambey (2021) showed the opposite effect instead.

Research to study the effect of firm age on the FV was performed by Lambey (2021), who showed that firm age does not affect the FV. On the contrary, the research conducted by Susanti and Restiana (2018) and Satrio (2022) showed that this variable correlated positively with the FV.

***Contributions.***

This study aimed to study the influence of capital structure, profitability, IO, firm size, and age on the FV, which is represented by the EV, by leveraging the regression tree (RT) model from the field of machine learning. The RT algorithm is an algorithm which able to split the data into several segments by minimizing the variance of the dataset. In this way, similar samples are concentrated inside a specific node, where later a linear model can be fitted into it, to understand the dynamics of the variable for that node. This idea was first presented by Hadi Santoso in 2024 to study how parameters behave at certain value ranges. By combining the concept of machine learning and the classical econometrics approaches, it is possible to better exploit how the dependent variables affect EV at different levels. In this study, the ROE is used as an indicator to measure profitability, while the debt-to-assets ratio (DAR) represents the capital structure. The IO is defined as the ratio of shares owned by the institutional investors to the total number of available shares. The firm size is measured by total assets, while the firm age is defined as the number of years that have passed since the initial public offering (IPO) up to the time of this research. We then divide the data into several segments by using the RT model, and then study how those variables affected the EV on certain values. Details of this process will be discussed in Section III.

This paper consists of five sections: the first section is the introduction. In Section 2, we present the theoretical background that supported this study. The third section will discuss the research methodology, including how the RT model is generated from the dataset. The fourth section will present the results and findings based on the conducted numerical simulation. Finally, in the last section, we conclude the results presented in this paper.

## 2. Theoretical Review

According to Ben (2026), FV can be used to represent assets owned by a firm, including marketable securities. Investors, in particular, expect higher returns on investment or at least returns that remain the same relative to the risk gained, based on the time value of money of their investment (Djaja, 2017: 3). The dynamics of stock prices depend on the performance of the firm. Specifically, a firm with good performance tends to attract more investors to invest in it, which ultimately raises the FV. This value can be measured from 2 different perspectives: internal and external. From the internal perspective, FV can be measured by considering the performance of a firm in generating net profit for investors, i.e., in the form of ROE (Anita, 2023). From the external perspective, the FV can be observed through the capital price of that firm, such as by observing the expectations of investors on the share price. In particular, this shows that FV can be measured by several parameters, such as price-earnings ratio (PER), earnings per share (EPS), market-to-book ratio, and market capitalization (Ross et al., 2015: 53-54), and EV (Ross et al., 2022).

The firm’s business operational activity is one of the firm's management duties in managing funding activities. During this process, management needs to observe and ensure that all regulations related to generating net profit are run optimally. In particular, the net gain is considered to be optimal if the management can utilize every resource and able to manage assets properly. These regulations include production, cost, promotion, human resources, and distribution. Specifically, an increase in profit margin can be used as an indicator of effective and efficient business operation regulation.

A firm with a high net profit margin demonstrates the firm's efficiency in managing assets and available funds, which is reflected through a high ROE (Mareta, 2022). A firm with a high ROE shows that it can manage its equity properly, which is often considered attractive to investors. In particular, when investors place greater trust in a firm, it is expected that that firm will have better prospects in the future. In particular, this claim is supported by several studies, such as those conducted by Susanti and Restiana (2018), Lubis et al (2017), and Ummah and Yuliana (2023), which showed that ROE correlates positively with the FV. Thus, based on the above explanation, we propose the following hypothesis:

**$H_1$: ROE correlates positively with the EV.**

A firm's funding decisions shape its capital structure. These decisions are closely related to the firm's life cycle, in addition to its overall size. Private companies, in particular, tend to rely more heavily on internal funding to support their operations, as obtaining external funding is generally more challenging and carries the risk of losing control of the firm (Damodaran 2014:295). However, internal funding also comes with its limitations, such as capital loss that must be calculated using the risk and return model.

Debt levels are an important consideration for investors because they relate directly to the firm's obligation to third parties and the accompanying interest costs. A firm with high debt levels indicates a continued dependence on external borrowing. According to Brigham and Houston (2021:504), dependency on debt is perceived to be a negative trait by investors, which decreases the FV. This is because high levels of debt increase the risk of bankruptcy, especially when the firm encounters financial issues.

On the other hand, companies with strong growth and good performance may choose to utilize debt to fund their expansion, given that the cost of debt is typically lower than the cost of issuing new equity. In this case, the investors might consider this choice as a positive choice, which will increase the FV. In particular, several research has shown this interesting result, including Hirdinis (2019), Asif and Aziz (2016), Yundari and Sedana(2020), Bui (2023), and Irawan (2022), who have shown that capital structure has a positive effect on FV. Based on this explanation, we considered the following hypothesis:

**$H_2$: DAR correlates positively with the EV**

GCG is essential to prevent conflicts of interest between managers who are entrusted with the authority and responsibility to manage the firm. Jerab (2023) stated that GCG reflects the structures and processes within and around an organization that allocate power and control over resources among participants. The implementation of GCG promotes better supervision of management performance through greater information transparency. In particular, this transparency helps the management to demonstrate greater caution when managing the firm, where every policy needs to be accountable. Maulana et al. (2002) used the IO as a proxy to measure the effectiveness of GCG. IO refers to the shareholding of the firm by major financial institutions such as insurance companies, banks, and other investment firms. Wu (2022) claimed that institutional shareholders can help minimize agency conflicts between managers and shareholders, which in turn will improve the firm's performance and value.

On the contrary, the research conducted by Jhang et al. (2020), Lestari (2017), and Ferriswara (2022) showed the opposite effect, where IO correlates negatively with the FV.

Thus, by observing this information, we proposed the following hypothesis:

**$H_3$: IO correlates positively with the EV**

Firm size denotes the size of a business entity based on the investor's perspective. Sui (2024) stated that the size of a firm reflects the magnitude of its operations. The larger the business, the greater the ability to generate FV. According to Ahmed (2023), firm size can be measured using several parameters, such as total assets. In particular, investors see large companies as a positive signal and prefer to invest in them, rather than in small companies. Thus, it is hinted that the firm size might affect the FV. This claim was further verified by the research conducted by Sui (2024) and Lambey (2021), who showed that the firm size correlates positively with the FV.

Thus, in this research, we also considered the following hypothesis:

**$H_4$: Firm size correlates positively with the EV**

Firm age denotes how long a firm has been operating. Companies that have been operating for a long time are often seen as more established and capable of overcoming various business-related problems. Susanti and Restiana (2018) stated that the more mature a firm is, the more information available for the investors. In particular, this information can then be used to judge the performance of the firm, which in turn increases the trust placed by investors in it. According to Rujin and Sukirman (2020), firm age also determines the level of risk faced. Specifically, they stated that younger companies are much more prone to uncertainty and competition due to their lack of experience. Therefore, it can be seen that the firm's age might affect the FV due to how investors perceive the firm's capability to handle business- related problems. Research conducted by Susanti and Restiana (2018) and Satrio (2022) confirmed this, in which they stated that firm age positively correlates with FV.

Based on the explanation above, the hypothesis proposed in this study is:

**$H_5$: Firm age correlates positively with the EV**

## 3. Research Methodology

This research is associative research, in which we considered a secondary dataset obtained from the Indonesian stock exchange (ind: Bursa Efek Indonesia). In particular, we collected data from 125 primary consumer sector companies from 2018 until 2023. The samples were collected by using the purposive sampling method, in which we selected companies that have been listed since 2017 and have never been suspended. Thus, eliminating 73 companies, leaving only 52 companies with 312 samples. The data was processed with MATLAB online, which is a semi-open programming language that is available without installation (registration is required for free 20 hours of access to the program).

This study aims to understand how the ROE, DAR, IO, firm size, and firm age affect FV, in this case represented by EV at a certain value. To reach this goal, first, the outliers are removed from the data. Then, the data is split into several segments by leveraging the RT algorithm based on a certain splitting criterion obtained from the independent variables. This partition ensures that every sample contained in any leaf is unique; it means that no 2 different leaves may have the same sample contained in them.

Let $l=1,2,\dots n$ denotes the number of leaves for the RT model, $\tau$. Then, for each leaf, it is possible to assign a linear model, as denoted below:

$$EV(x_i)=\alpha_i ROE(x_i)+\beta i DAR(x_i)+\gamma i IO(xi)+\delta_i F_S(x_i)+\epsilon_i F_a(x_i)+c_i+\varepsilon_i \quad (1)$$

Where: $EV(x_i)$, $DAR(x_i)$, $IO(x_i)$, $F_S(x_i)$, $F_a(x_i)$, $\epsilon(i)$ and $c_i$ denote the EV, DAR, IO, the firm size, the firm age, and the model constant of samples contained in leaf $i$, respectively.

Next, to validate the result, before concluding the hypotheses for each node, we will perform a classical assumption test on the linear model generated based on samples on each leaf node. In this case, however, due to the nature of the algorithm, which splits the data by minimizing

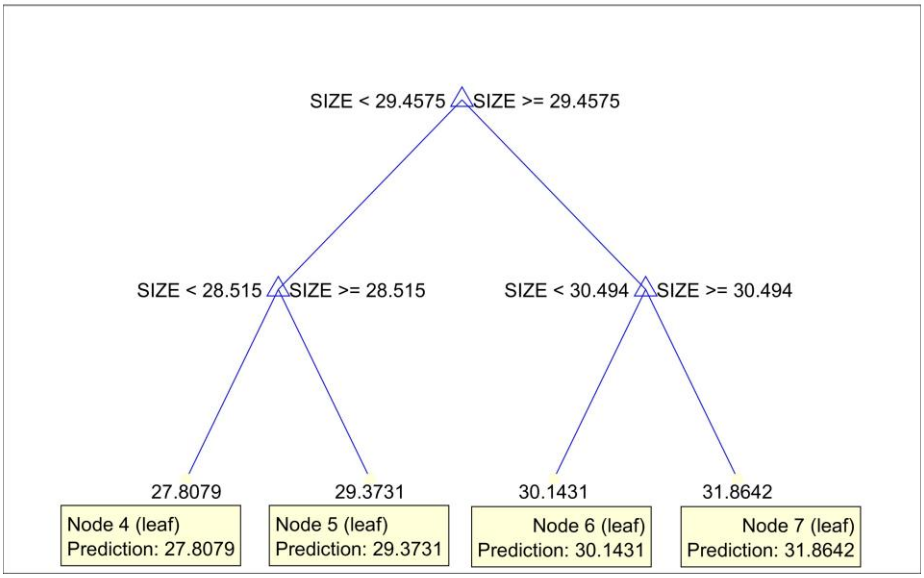


**Figure 1. the tree graph representation of the data. The value located in each node (e.g., 27.80 in node 4) denotes the average of the EV contained in that node.**

the variance, the data is no longer panel data but closely resembles cross-sectional data. Thus, the autocorrelation assumption is omitted as it is satisfied automatically.

**Table 1. The splitting criterion for each node**

| N° Node | Condition |
|---|---|
| Node 4 | Firm size < 28.52 |
| Node 5 | 28.52 ≤ Firm Size < 29.45 |
| Node 6 | 29.46 ≤ Firm Size < 30.49 |
| Node 7 | Firm size ≥ 30.49 |

## 4. Result and Discussion

In this section, we presented the results obtained from the numerical simulations. In particular, we will start the discussion by presenting the results obtained from the overall model, such as the tree structure and the Gini index, which offer information about the most important variable.

Next, we will interpret the result for the model contained in each leaf. This model needs to pass the classical assumption test, which is: normality via the Kolmogorov-Smirnov test, the Heteroscedasticity by using the Breusch-Pagan test, and the variance inflation factor. As in the previous explanation, the autoregressive test is

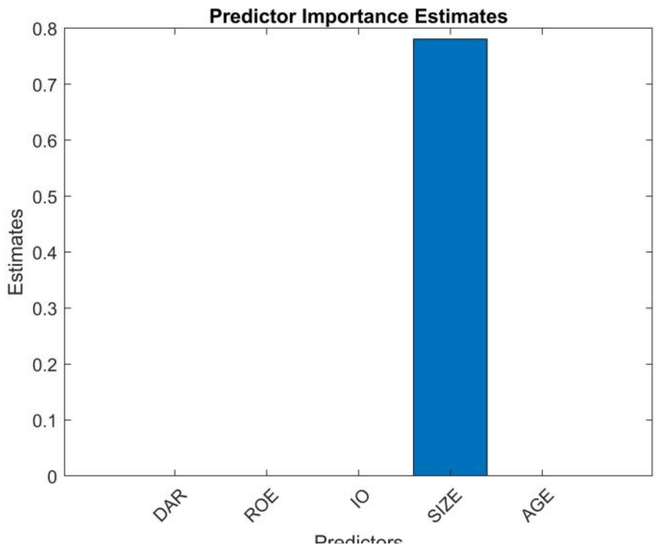


**Table 2. The classical assumption test for 4 nodes. The autocorrelation test is omitted due to the data in each node is no longer sorted chronologically (i.e., no longer panel data).**

| Test | Node 4 | Node 5 | Node 6 | Node 7 |
|---|---|---|---|---|
| **Normality** (Kolmogorov-Smirnov) | 0.38 | 0.91 | 0.60 | 0.81 |
| **Heteroscedasticity** (Breusch-Pagan) | $0.97\times10^{-2}$ | 0.15 | 0.24 | 0.90 |
| Multicollinearity (VIF) | | | | |
| DAR | 2.27 | 1.36 | 1.42 | 1.83 |
| ROE | 2.07 | 1.66 | 1.11 | 2.56 |
| IO | 1.14 | 1.03 | 1.23 | 1.38 |
| SIZE | 1.24 | 1.17 | 1.22 | 1.20 |
| AGE | 1.149 | 1.47 | 1.29 | 1.81 |
| Conclusion | Failed (BP-test) | Passed | Passed | Passed |

***significant at alpha = 5%**

omitted from the test, since the data is no longer panel data due to the regression tree split. We constructed the tree in such a way that each node contains at least 50 samples, to make the analysis meaningful (i.e., to satisfy the central limit theorem).

### 4.1 Overall Model Analysis

Figure 1 shows the regression tree model for the data, while Figure 2 shows the result of the parameter importance estimate based on the Gini Index. From Figure 1, it can be seen that the whole dataset is divided into 4 different leaf nodes, namely nodes 4, 5, 6, and 7. Table 1 summarizes the result of the splitting criterion for each node. In particular, from Table 1, a firm is considered in node 4 if the firm size is less than 28.52. It is considered in node 5 if the firm size is between 28.52 and 29.45, while it is in node 6 if the firm size is between 29.46 and 30.49. Finally, a firm is considered to be in node 7 if the firm size is greater than 30.49. From this information, it suggests that a firm is considered to be a small firm if the firm size is less than 28.52, while it is a big firm if it is greater than 30.49.

The next step is to check whether the model in each node satisfies the classical assumption. This process is needed to ensure that the result obtained in this node is not affected by any bias or external effect that is not considered in the model. Table 2 summarizes the classical assumption test results for all 4 nodes. From Table 2, all nodes passed the classical assumption test, except node 4, where the heteroscedasticity test of the node shows a significant result (i.e., there is a heteroscedasticity issue with the residual). Therefore, while the result for node 4 will still be presented, it is worth noticing that the analysis drawn from this node might not be reliable.

It is worth noting, however, that all nodes passed the normality test. This result shows that the RT algorithm can be used to split the data while maintaining the normality of the dataset. In particular, the proposed method can be used as an alternative to the panel data analysis, which often requires a significant amount of knowledge in time series analysis.

### 4.2 Node 4: Firm size < 28.52

Table 3 shows the result of the ANOVA and the F-test for the model in node 4. From Table 3, we can see that the model is significant (i.e., better than a constant model) with r-squared ($r^2$) of 0.613. From the model, out of 5 parameters, there are 3 significant parameters: the ROE, size, and age.

**Table 3. The ANOVA and Model Test for Node 4.**

| **Model Significance** | | | | | |
|---|---|---|---|---|---|
| F test | 13.6 ($p$-value = $1.26\times10^{-9}$) | | | | |
| $r^2$ | 0.613 | | | | |
| $N$° sample | 81 | | | | |
| **ANOVA** | | | | | |
| **Parameter** | **Max** | **Min** | **Variance** | **Estimate** | ***p*-value** |
| DAR | 0.95 | 0.098 | 0.047 | 0.371 | 0.420 |
| ROE | 0.274 | -1.480 | 0.082 | 0.665 | 0.048 |
| IO | 1.000 | 0.364 | 0.025 | 0.318 | 0.475 |
| Size | 28.505 | 26.647 | 0.221 | 1.013 | $6.91\times10^{-9}$ |
| Age | 39.000 | 1.000 | 118.780 | -0.015 | 0.028 |
| Intercept | - | - | - | -0.315 | 0.942 |

*significant at alpha = 5%

For a small enterprise, in this case characterized by a firm size less than 28.52, the increment of the firm size is associated with a higher EV. Investors most likely perceive size as a proxy for resource capacity, market presence, and stability, thereby reinforcing its importance for small enterprises. The same could be said for ROE, which correlates significantly positively with the EV. As expected, investors valued more companies that were generous to the shareholders and able to bring more income.

On the contrary, age correlates negatively with EV. This indicates that firms in this cluster are considered to be interesting if they are relatively young. In the sense that the investor valued smaller companies more than older small companies. This result reflects the preference of the investors who prefer innovative and more agile companies.

Meanwhile, the DAR and IO are not significant for this cluster of data. The insignificance of DAR is most likely due to the relatively uniform leverage level, which is not considered a major risk for smaller companies. Similarly, smaller companies tend to have a similar level of ownership, which does not significantly affect the EV. Overall, this result indicated that small companies in Indonesia's EV are controlled by the ROE, size, and age. While the capital structure and ownership characteristics play a lesser role.

Therefore, only $H_1$ and $H_4$ are accepted for small-sized companies, while the rest of the hypotheses are rejected.

### 4.3 Node 5: 28.52 ≤ Firm Size < 29.45

Table 4 shows the regression result for data in node 5, which is for companies with a firm size between 28.52 and 29.45. The model is significant, with $r^2$ of 0.358. As in the previous case, the ROE, size, and age are still significant, with the addition of IO, which is significant at $\alpha$=10%.

First, the ROE is still considered a significant factor for the EV for medium-range enterprises. This shows that investors are interested in companies that can generate large returns for them. The same can be said for the size, where growth in size is valued positively by the market. In contrast to node 4, age in node 5 correlates positively with EV. This shows that investors value experience in managing an enterprise for medium-sized enterprise. In particular, this indicates that investors prefer medium-sized firms with a longer operational history, as they are seen to be able to generate consistent returns and maintain sustainable growth.

While it is insignificant at 0.05, the IO exhibits a borderline significance for medium-sized enterprises. This result suggests that institutional investors may play a more prominent role in the valuation of medium-sized firms. This might be an indication as well that the investors are interested in firms that maintain high governance standards and stability, which in this case is more likely to be found than in the previous case (i.e., small firms).

Overall, the results presented in this node show that ROE, size, and age remain significant in affecting the EV. Also, the IO seems to be positively correlated to the EV, even though it is only significant at $\alpha$=0.1. This highlights the importance of growth, profitability, and experience in driving the value of the firm for this node. Concerning the hypotheses, only $H_1$, $H_4$ and $H_5$ are accepted for mid-sized companies, while the rest are rejected.

### 4.4 Node 6: 29.46 ≤ Firm Size < 30.49

Table 5 shows the summary of the results obtained from the regression model in node 5. Unlike in the previous node, the model in this node is insignificant. Hence, the result presented in this model might not be worth discussing, as the linear model failed to present the dynamics of the data in this node. The result presented in Table 5 is due to the nature of the data not properly captured by this node. In particular, this node can be considered a 'transition node', which is a node that contains a collection of firms that do not align properly with behavioral patterns in other nodes. The firms in this node exhibited a heterogeneous pattern or underlying irregularities, such as latent outliers that obscure

**Table 4. The ANOVA and Model Test for Node 5.**

| Model Significance | | | | | |
|---|---|---|---|---|---|
| F test | 7.82 ($p$-value = $6.83\times10^{-6}$) | | | | |
| $r^2$ | 0.358 | | | | |
| *N*° sample | 78 | | | | |
| **ANOVA** | | | | | |
| **Parameter** | **Max** | **Min** | **Variance** | **Estimate** | ***p*-value** |
| DAR | 0.967 | 0.106 | 0.049 | 0.326 | 0.310 |
| ROE | 1.052 | -2.549 | 0.243 | 0.569 | 0.001 |
| IO | 0.979 | 0.214 | 0.044 | 0.578 | 0.052 |
| Size | 29.448 | 28.525 | 0.068 | 0.750 | 0.004 |
| Age | 42.000 | 3.000 | 101.180 | 0.017 | 0.024 |
| Intercept | - | - | - | 6.739 | 0.360 |

*significant at alpha = 5%

any systematic relationship between predictors and the EV. As such, node 6 might be best interpreted as a transitional node or unstable segment of the data. Thus, there is no need to test the significance of hypotheses for this node.

**Table 5. The ANOVA and Model Test for Node 6.**

| Model Significance | | | | | |
|---|---|---|---|---|---|
| F test | 1.54 (*p*-value = 0.193) | | | | |
| $r^2$ | 0.141 | | | | |
| *N*° sample | 53 | | | | |
| **ANOVA** | | | | | |
| **Parameter** | **Max** | **Min** | **Variance** | **Estimate** | ***p*-value** |
| DAR | 1.188 | 0.119 | 0.065 | 0.608 | 0.065 |
| ROE | 2.555 | -1.103 | 0.201 | -0.117 | 0.474 |
| IO | 0.925 | 0.173 | 0.032 | -0.684 | 0.118 |
| Size | 30.490 | 29.467 | 0.094 | 0.335 | 0.183 |
| Age | 33.000 | 5.000 | 75.227 | 0.015 | 0.106 |
| Intercept | - | - | - | 19.996 | 0.010 |

*significant at alpha = 5%

### 4.5 Node 7: Firm size ≥ 30.49

Table 6 presents the result of the regression analysis for node 7, which is a node considered to be a collection of big firms (i.e., firm size greater than 30.49). The regression model for node 7 is highly significant, as reflected by a very low model p-value and $r^2$ of 0.712. out of 5 predictors, only age is the predictor that does not affect the EV of this node.

As in the previous node, the ROE and firm size remain significant predictors for the EV. This result is pretty much expected for big companies due to their potential to generate profits. Interestingly, only in this node is the DAR significant and correlates negatively with the EV. This suggests that investors are more sensitive to the financial structure at this scale, due to the debt sustainability in larger balance sheets. Furthermore, IO, which is a parameter that is not significant in the previous nodes, appears to be significant and negatively correlated with the EV. This might be an indication that the investors avoided large companies with a lot of owner involvement, potentially reducing external investors' confidence.

Another interesting result comes from the age, in which age is insignificant to this node, contrary to the previous nodes. This indicates that age does not matter for big companies, as such enterprises have been proven to be able to generate large profits for the investor. In general, for large companies, the firm value is mostly shaped by profitability, financial structure, and

**Table 6. The ANOVA and Model Test for Node 7.**

| Model Significance | | | | | |
|---|---|---|---|---|---|
| F test | 34.1 (*p*-value = $2.21\times10^{-17}$) | | | | |
| $r^2$ | 0.712 | | | | |
| *N*° sample | 75 | | | | |
| **ANOVA** | | | | | |
| **Parameter** | **Max** | **Min** | **Variance** | **Estimate** | ***p*-value** |
| DAR | 0.782 | 0.240 | 0.023 | -2.351 | $7.56\times10^{-6}$ |
| ROE | 1.451 | -0.131 | 0.117 | 2.549 | $4.30\times10^{-15}$ |
| IO | 0.925 | 0.301 | 0.028 | -1.249 | 0.002 |
| Size | 32.826 | 30.498 | 0.362 | 0.762 | $6.93\times10^{-11}$ |
| Age | 41.000 | 7.000 | 87.955 | -0.009 | 0.246 |
| Intercept | - | - | - | 9.604 | 0.003 |

*significant at alpha = 5%

ownership characteristics, and these factors are considered to be "interesting" for investors. For the hypotheses, only $H_1$ and $H_4$ are accepted, while the rest are rejected.

### 4.6 Discussion

In this paper, we considered a novel method to analyze how financial parameters such as DAR, ROE, firm size, age, and IO affect the firm value or EV by leveraging the RT from the CART algorithm. The RT has successfully segmented the dataset into 4 different clusters, which can be identified based on their firm size.

For small enterprises, in this case, represented by node 4, it was revealed that ROE, age, and firm size were the significant predictors of the dynamics of the EV. ROE and firm size positively affect the EV, suggesting that the profitability and the marginal increase in the size of companies boosted the investors' interest in such companies. Interestingly, age correlates negatively with the enterprise value, suggesting that investors prefer young companies, which are often considered to be more agile and bring more innovation. Furthermore, DAR and IO do not affect the EV for small enterprises. In particular, this phenomenon is due to the leverage and ownership patterns in small enterprises.

For medium-sized enterprises, ROE, age, and firm size appear to be significant variables in predicting the EV, as in the previous case. However, unless in the previous case, the age correlates positively with the EV. This indicates that investors preferred more experienced companies for medium-sized firms. Also, in this case, the IO seems to affect these kinds of firms, although it is only significant at a 90% confidential level. This result indicates that the ownership role in medium-sized companies has begun to draw the attention of investors.

Finally, for large-sized firms, all predictors except age significantly affect the EV. In particular, the DAR has become negatively correlated to the EV, emphasizing that the leverage risk becomes critical at large-scale companies. The IO has also become negatively correlated to the EV, indicating that the ownership role in companies may be viewed as a government risk in large companies. Age, however, has lost its significance to the EV for large companies, hinting that maturity concerns less as a firm grows into a large firm.

In summary, it can be concluded that the influence of predictors depends on the firm size. Specifically, ROE and firm size constantly affect the EV in positive ways, while the age changes depending on the firm size. This pattern validates the use of the RT to uncover non-linear and context-specific relationships among variables. By building several linear models within homogeneous samples, the methodology not only preserves statistical validity but also helps to enrich the analysis of companies' firm value in Indonesia.

## 5. Conclusion

This study bridges the gap between machine learning and classical econometrics by applying the RT algorithm to create partitions of data and assign a linear model to it. This approach allows for a meaningful interpretation of how DAR, ROE, firm size, age, and IO affected the EV based on the firm size.

This result indicates that firm size is a critical variable in determining the relevance of financial predictors. In particular, ROE and firm size maintained strong positive effects on the EV, while the variables DAR and IO only affected the EV in large-scale companies. Also, the importance of age seems to decline as companies grow, hinting that the age of companies only matters for younger companies.

Overall, the integration of tree-based segmentation with linear models demonstrates a powerful analytical framework that is useful in handling heterogeneous data, which is considered to be a challenge for the classical approach. Future work might explore the inclusion of interaction effects or the application of similar frameworks to other emerging markets and financial environments.

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