Statistics for Business Pacmann-Value Relevance of Accounting Information

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Disclaimer

- This project is oversimplification of what industry currently doing

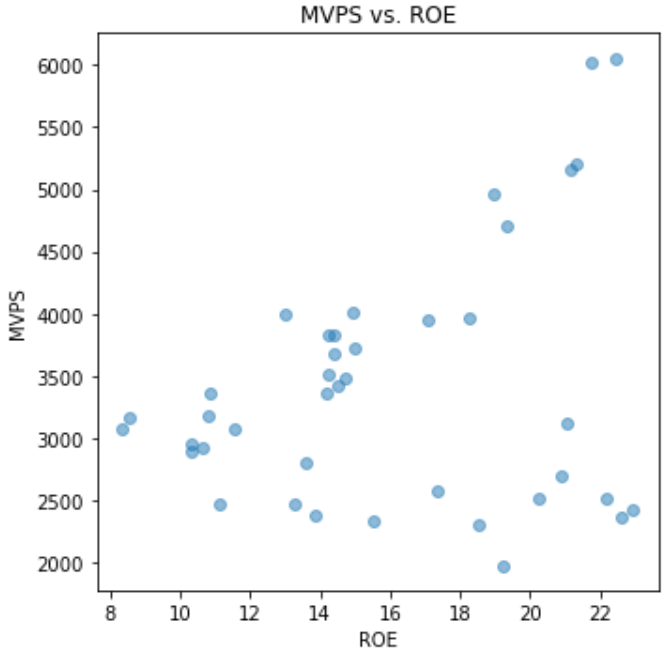
Goal of The Project

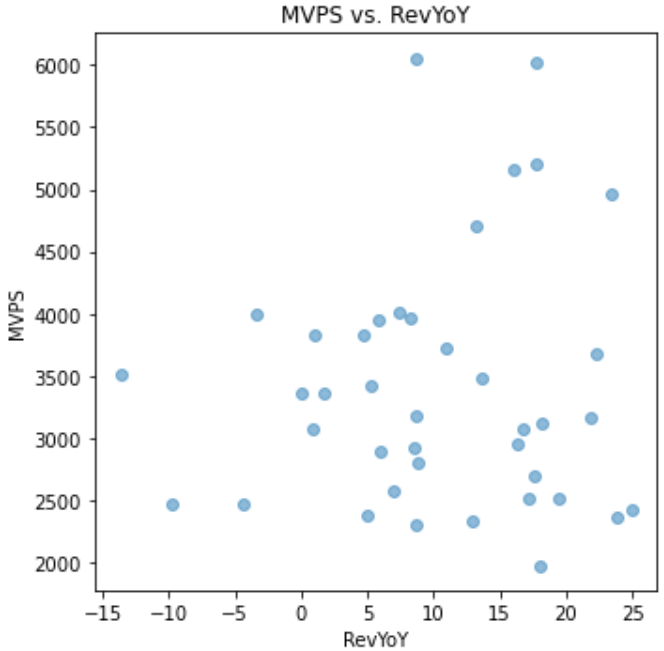
- This is a simple multiple regression using value relevance of accounting information. For this project, we are using Bank Mandiri (BMRI) as an example. We are trying to predict the Market Value per Share(MVPS) using several predictors (ROE, Revenue Growth, Book Value per Share, Dividend Yield and Price to Book Ratio.

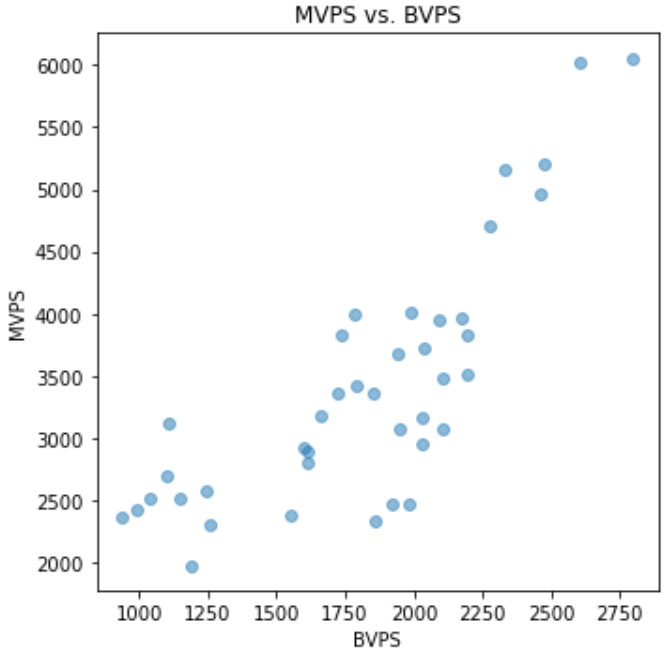
Data

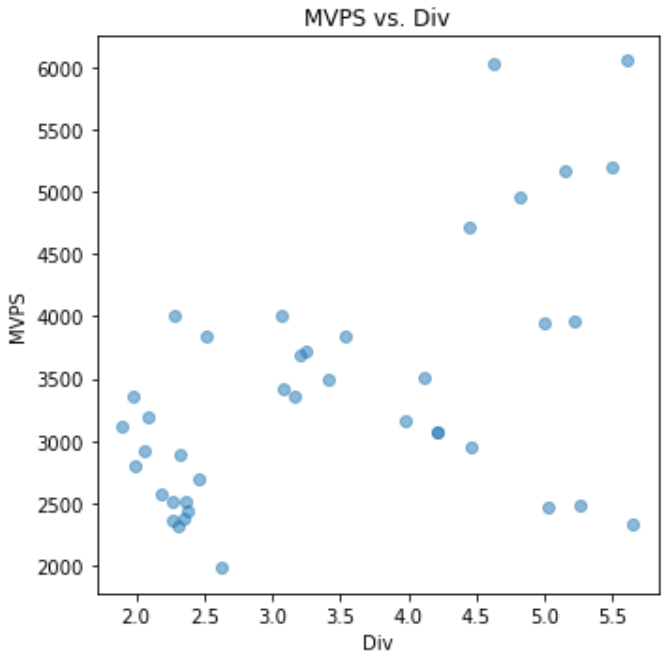
- We are using quarterly data from March-2014 to Dec-2023
- The data extracted from Bloomberg terminal
- Later on, we centered the data for the sake of interpretation

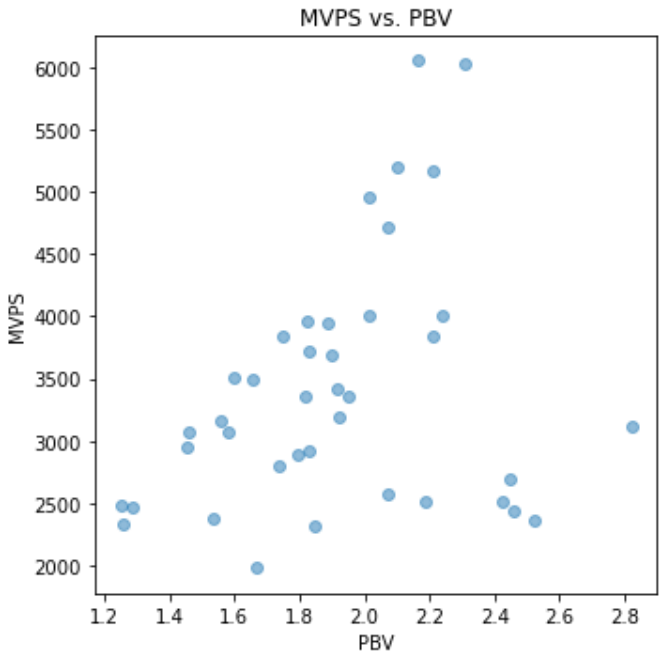
Scatter Plot











Scatter Plot

- Before doing multiple regression, we need to check the nature of the data using scatter plot
- The pattern of scattered data points tell us what data transformation and what model that are suitable for the project
- The data in scatter plot seems too random and a bit problematic but for this project only we ignore it and brute force the usage of ols

OLS

- We regress the data using OLS and find negative intercept which is not meaningful for market value to be negative if all else zero.
- High R-squared, a strong indication of overfitting. We are well aware and proceed for the sake of simplicity.

OLS Regression Results

Dep. Variable:	MVPS	R-squared:	0.987
Model:	OLS	Adj. R-squared:	0.985
Method:	Least Squares	F-statistic:	529.6
Date:	Wed, 06 Mar 2024	Prob (F-statistic):	3.25e-31
Time:	18:09:19	Log-Likelihood:	-245.52
No. Observations:	40	AIC:	503.0
Df Residuals:	34	BIC:	513.2
Df Model:	5		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-3618.0834	163.915	-22.073	0.000	-3951.198	-3284.969
ROE	25.2183	8.746	2.883	0.007	7.444	42.992
RevYoY	-0.8258	2.500	-0.330	0.743	-5.906	4.254
BVPS	2.4035	0.077	31.195	0.000	2.247	2.560
Div	-132.9710	34.530	-3.851	0.000	-203.144	-62.798
PBV	1432.8257	104.554	13.704	0.000	1220.346	1645.306

Omnibus:	2.632	Durbin-Watson:	1.214
Prob(Omnibus):	0.268	Jarque-Bera (JB):	2.090
Skew:	-0.560	Prob(JB):	0.352
Kurtosis:	2.960	Cond. No.	1.77e+04

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.77e+04. This might indicate that there are strong multicollinearity or other numerical problems.

Centering

- To make the interpretation more meaningful, we center all the predictors

$$X_{centered} = X - \bar{X}$$

Where:

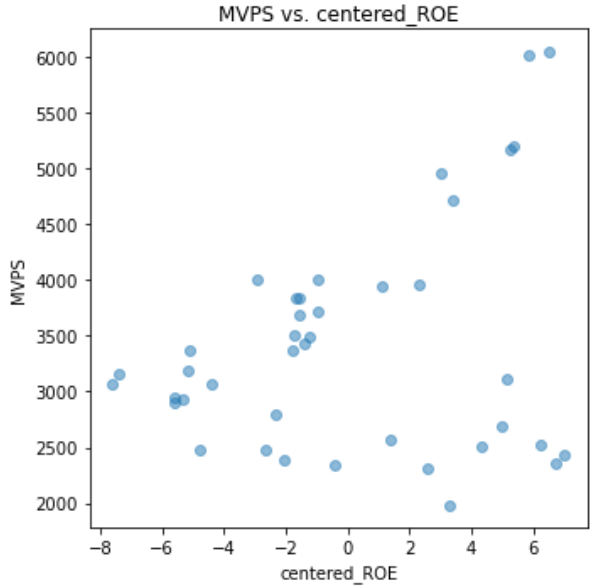
- $X_{centered}$ is the centered value of an original data point,
- X is the original value of the data point, and
- $\bar{X}$ is the mean of all the data points in the data set.

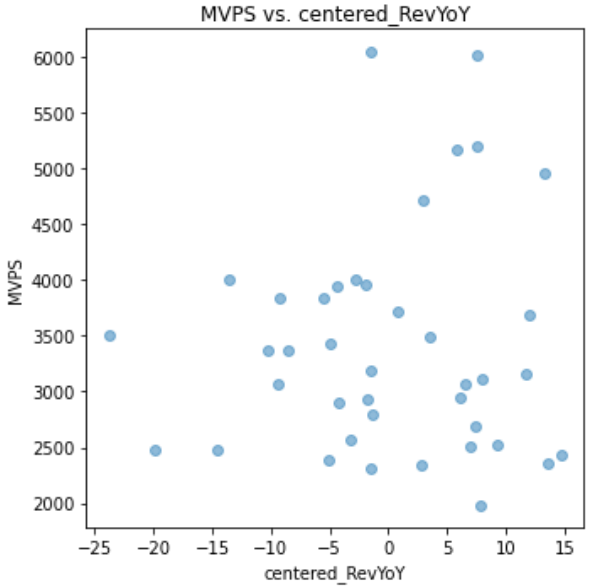
Centering (2)

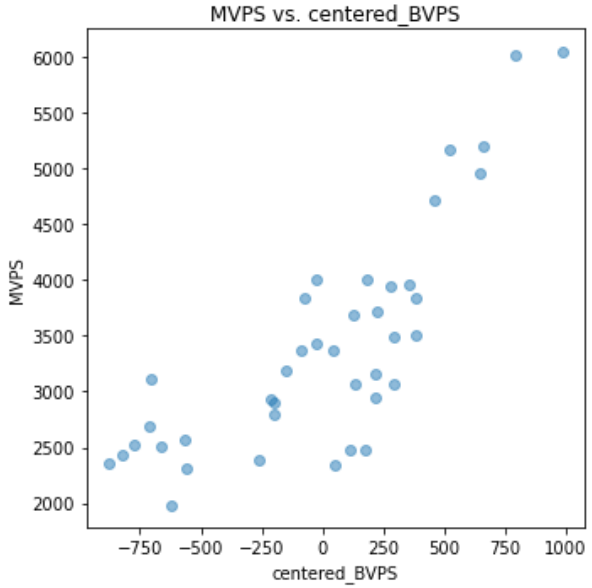
- The head of data look like the following table

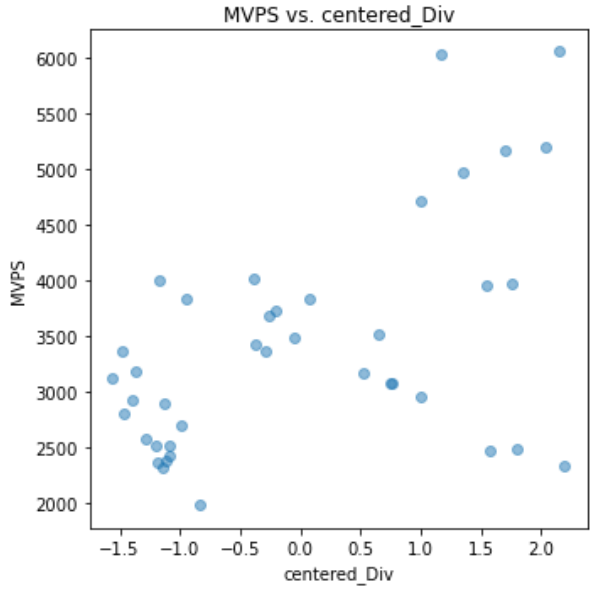
	Date	MVPS	ROE	RevYoY	BVPS	Div	PBV	centered_ROE	centered_RevYoY	centered_BVPS	centered_Div	centered_PBV
0	12/31/2023	6050	22.4491	8.6603	2794.8513	5.6084	2.1647	6.505897	-1.502135	983.221778	2.149398	0.250018
1	9/30/2023	6025	21.7746	17.7238	2606.8879	4.6281	2.3112	5.831397	7.561365	795.258378	1.169097	0.396518
2	6/30/2023	5200	21.3087	17.7856	2475.1018	5.4917	2.1009	5.365498	7.623165	663.472278	2.032697	0.186218
3	3/31/2023	5163	21.1683	16.0229	2333.1348	5.1593	2.2127	5.225098	5.860465	521.505278	1.700298	0.298017
4	12/31/2022	4963	18.9567	23.4616	2460.8442	4.8154	2.0166	3.013498	13.299165	649.214677	1.356397	0.101917

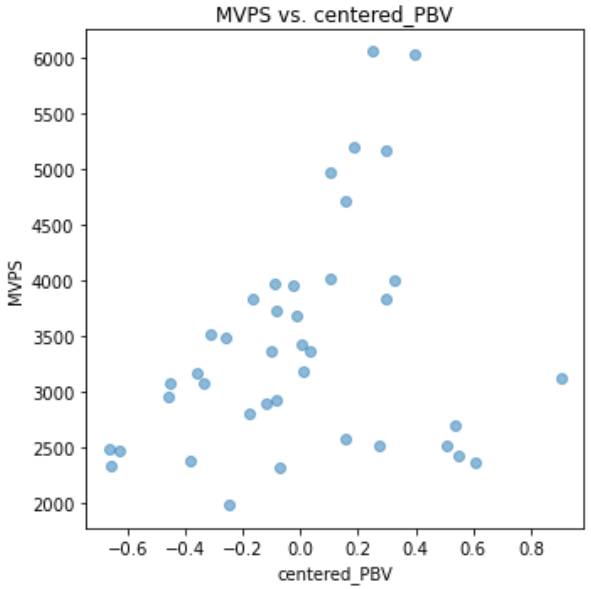
Scatter Plot of Centered Variables











OLS – Centered Variables

- We re-do the multiple regression with centered x-variables
- The intercept is positive therefore can be interpreted meaningfully .
- No major changes in R-squared and all but revenue growth (RevYoy) variable is significant based on p-value

OLS – Centered Variables Result

OLS Regression Results

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Df Residuals:	34	BIC:	513.2
Df Model:	5		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	3413.3750	19.219	177.603	0.000	3374.317	3452.433
centered_ROE	25.2183	8.746	2.883	0.007	7.444	42.992
centered_RevYoY	-0.8258	2.500	-0.330	0.743	-5.906	4.254
centered_BVPS	2.4035	0.077	31.195	0.000	2.247	2.560
centered_Div	-132.9710	34.530	-3.851	0.000	-203.144	-62.798
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Omnibus:	2.632	Durbin-Watson:	1.214
Prob(Omnibus):	0.268	Jarque-Bera (JB):	2.090
Skew:	-0.560	Prob(JB):	0.352
Kurtosis:	2.960	Cond. No.	2.59e+03

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 2.59e+03. This might indicate that there are strong multicollinearity or other numerical problems.

Test for Multicollinearity and Heteroskedasticity

- We also test the model for multicollinearity, relationship between predictors that might lead to unstable coefficients
- Using common sense, many accounting data have tendency of multicollinearity but the vif of the predictors are below 10 suggesting no multicollinearity
- We also test for heteroskedasticity, that indicates that the residual varies that leads to inefficient estimates and unreliable significance test, using Breusch pagan and the t-test is 3.34 with insignificant p-value, implying fail to reject h0 of homoskedasticity meaning no heteroskedasticity in the model.

VIF Result

	Feature	VIF
0	const	1.000000
1	centered_ROE	3.756917
2	centered_RevYoY	1.392994
3	centered_BVPS	3.459485
4	centered_Div	4.877197
5	centered_PBV	3.784449

Heteroskedasticity Result

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Breusch-Pagan Test Statistic: 3.342952147486269
p-value: 0.6472724207500997
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Simulate the Model

- Now we test the model using the coefficients generated from the multiple regression.

Y = 3413.375 + 25.2183X1 – 0.8258X2 + 2.403X3 -132.97X3 + 1432.82X4

Input numbers :

centered_ROE = 3.59

centered _RevYoY = -8.08

centered _BVPS = 159.13

centered _Div = 0.89

centered _PBV = 0.36

Result of the simulation

- Centered ROE (3.59): This value indicates that the Return on Equity (ROE) for the simulated scenario is higher than the average ROE by approximately 3.59 units (after centering). A higher ROE suggests that the company is more efficient at generating profits from its equity, which is generally viewed positively by investors and can contribute to a higher market value per share (MVPS).
- Centered RevYoY (-8.08): The negative value suggests that the Year Over Year Revenue (RevYoY) growth for the simulation is lower than the average by about 8.08 units. Lower revenue growth could be a concern for investors as it might indicate slowing business activities or increased competition, potentially negatively impacting the MVPS.
- Centered BVPS (159.13): This positive value indicates that the Book Value Per Share (BVPS) is above the average by approximately 159.13 units. A higher BVPS often indicates that a company has more assets relative to its shares, which can be seen as a positive indicator of underlying value, contributing positively to the MVPS.
- Centered Div (0.89): The positive value here suggests that the dividend (Div) is higher than the average by about 0.89 units. Higher dividends can be attractive to investors seeking income, potentially increasing the MVPS. However, it's essential to consider that very high dividends could also indicate that the company might not be reinvesting enough profits back into the business for growth.
- Centered PBV (0.36): A positive value for the Price to Book Value (PBV) ratio, centered around the mean, indicates that the company's stock might be valued higher by the market relative to its book value by about 0.36 units. A higher PBV ratio can suggest that investors are willing to pay more for each dollar of book value, often due to expectations of future growth, which positively affects the MVPS.
- **The predicted MVPS of 4293.13,** based on the simulated values, suggests that the company is valued relatively highly in the market under these conditions. The higher ROE and BVPS contribute positively to this valuation, indicating efficient profit generation and a strong asset base. However, the lower revenue growth (RevYoY) could be a point of concern, potentially offset by the positive aspects of higher dividends and a higher PBV ratio, which reflect investor confidence and the anticipated future growth. It's crucial to consider that this interpretation is based on a simplified linear model and simulated data, and real-world scenarios might involve more complex dynamics and additional factors.