Relationship of brand value and company performance (ROI, ROE, P/E, P/B, EPS)

Research conducted
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Content

Aim of the research

An appropriate brand establishment is one of the main concepts of successful company performance. The most famous companies in the world are world-wide known not only due to the high quality of their product, but also due to their name, positioning and values , which can be outlined as ‘brand’. Many investors before investing their money pay attention not only on such metrics like returns, risk rate etc, but also on the company's positioning on the market.

My hypothesis is that companies with great brand value generate positive stock returns and show better performance on the market because marketing activities are reflected in stock prices and on the company’s returns. The fact that brand value generates positive returns, demonstrates that investors will gain even more if they will also focus on brand value.

I will use the main performance measures that many investors are looking at before investing in the company. These are - ROI, P/E, Market-to-book value, Earnings per Share, ROE.

For checking my hypothesis I will use popular companies with well-established brands. That are Apple, Amazon, IBM, Google, Microsoft, McDonald’s, Starbucks. Those companies are from different fields (tech, food, selling).

Data

Brand Value - is the financial amount your brand is worth, based on an amount on the balance sheet.
Return on Investment (ROI) - measure to evaluate the efficiency of investment. ROI = Net Profit / Total Investment * 100
Price/Earnings ratio - relates a company's share price to its earnings per share.[1]
Price/Book or Market/Book - metric used to evaluate a company’s current market value relative to its book value. The book value equals the net assets of the company.
Return on Equity (ROE) - is a measure of financial performance calculated by dividing net income by shareholders' equity
Earnings per share (EPS)- is a metric describing a public company's profit per outstanding share of stock.

[1] https://www.investopedia.com/terms/p/price-earningsratio.asp

Methodology

The first step in my research was to find the correlation between performance measures and brand value. This step is conducted to understand if we can expect any significant relationship between brand value and those measures.

After correlations were found, I selected those variables, which had positive correlation with brand value.

Then I conducted the OLS linear regression with brand value as independent variable and performance variable as dependent variable for each company (7 regressions). As some regressions had biases, I did heteroskedasticity and serial correlation corrected OLS.

The next step was to check the influence of brand value on performance measure in the panel data case. So, I formatted data into a panel and conducted a pooled OLS regression.

Then to avoid heteroskedasticity, serial correlation and bias of standard errors, I did pooled OLS corrected for heteroskedasticity and serial correlation.

But what if there is some unobserved fixed effect - some manager's skill,for example. To eliminate the opportunity of this , I made a Fixed Effect regression (I did 2 options - standard one and LSDV).

Then I conducted some tests to understand the accuracy of regressions and decide which is better.

Also, I can assume that those unobserved factors are stochastic (random). In this case, I did Random Effect regression and corrected it for heteroskedasticity and serial correlation.

Then I did a Hausman Test to decide which model works better, to test a statistical significance of difference between coefficients of RE and FE.

Finally, I did First Difference model regression.

Tests

- bptest() - Breusch-Pagan test for homoscedasticity of panel data.
- pFtest() - F test - testing for fixed effects/deciding which model is better - pooled OLS or FE;
- plmtest() - Breusch-Pagan Lagrange Multiplier for random effects. Null is no panel effect (i.e. OLS better).
- pbgtest() - Breusch-Pagan LM test for serial correlation.

Results

1. On the correlation step I made correlation matrices and plots for each company, where correlation between brand value, ROI, P/E, Market-to-book value, Earnings per Share.

   Correlation plots can be found here.

   Main result is that for all companies a strong positive relationship is between brand value and Earnings per Share. Some other variables have also significant correlation, but I chose the one which is strongly correlated with Brand Value for all companies.

   So, now I have the hypothesis that brand value has an impact on earnings per share.

2. On this step I made the OLS regressions separately for each company.

   Model looked like:

   $$eps = \beta_0 + \beta_1 brand_{value} + \varepsilon$$

   After correcting for heteroskedasticity, I got the results which indicated statistical significance of variable $brand_{value}$. The coefficient has positive sign, what means that increase in $brand_{value}$ implies increase in eps.

   Detailed regressions summary and description can be found here.

   All regressions rejected H0.

3. Then I made panel data with companies, years, eps, brand_value.
4. In the pooled OLS regression with robust SE $brand_{value}$ variable was also statistically significant , having positive relationship with eps. The coefficient of $brand_{value}$ is 0.072396.

   From pooled OLS I can conclude that $brand_{value}$ has an impact on Earnings per Share.

5. Next regression is the standard Fixed Effects model to eliminate the probable unobserved factor. After making it corrected for heteroskedasticity, I have got the $\beta_1 = 0.0719495$ with p-value < 2.2e-16, that makes β_1 statistically significant. The coeff of $brand_{value}$ indicates how much ***eps*** changes overtime, on average per country, when $brand_{value}$ increases by one unit.

   The other one Fixed Effects model I did with dummy variables, and got a bit different but similar results. $\beta_1 = 0.073853$. The coefficient of brand_value indicates how much eps changes overtime, controlling by differences in companies, when $brand_{value}$ increases by one unit.

6. I conducted a F-test to test the fixed effect and choose which model is better - pooled or FE. If the p-value is < 0.05 then the fixed effects model is a better choice. p-value = 0.9998 that indicates that pooled OLS is better.

   Then I made a Lagrange Multiplier Test for random effects. Null is no panel effect (i.e. OLS better). p-value < 2.2e-16, accept the H0 and conclude that random effects are appropriate

Last test on this step was Breusch-Godfrey Test for Panel Models - Test of serial correlation for (the idiosyncratic component of) the errors in panel models. p-value = 2.099e-14 -> that means no serial correlation.

7. We can assume that those unobserved factors are stochastic and run Random Effects regression (corrected, with robust SE). There I got that $brand_{value}$ is statistically significant variable with $\beta_1 = 0.0723955,\ p-value < 2e-16$.
8. To decide between Fixed Effect and Random effect I performed Hausman Test, that indicated p-value = 0.9497. As p-value is too high (>0.05) , so we use the Random Effect model.
9. Another way to eliminate the unobserved effect was First Difference estimator (robust one). It stated that $brand_{value}$ is statistically significant variable with $\beta_1 = 0.046330,\ p-value = 0.000657$.

Conclusion

The purpose of the research was to examine if brand value affects company's performance. Although correlation for such measures like P/E, P/B, ROI, ROE was pretty insignificant, there was found one metric - Earnings per Share - for which brand value is the 'impact measure'.

After running multiple regressions that included simple OLS LM, pooled OLS for panel data, Fixed Effects model, Random Effects Model, First Difference estimator, I came to the conclusion that Brand Value has a significant impact on Earnings per Share in any case.

What is more - I have analyzed the relationship between Brand Value and EPS in both cases - separately for each of the 7 companies, and then combining them all into the panel data. In both cases, the relationship was obtained.

Furthermore, some tests were conducted to gain precise results, eliminate heteroskedasticity and serial correlation and choose the most explaining model. Among models that eliminate unobserved factors - Random Effects is the most relevant one due to the Hausman test.

Finally, I can conclude that brand establishment is actually the significant factor that has the relationship with important performance measure - Earnings per share.

To sum up, marketing activities are partially reflected in company performance measure - earnings per share. They [activities] can be useful to examine before investment.

Appendix

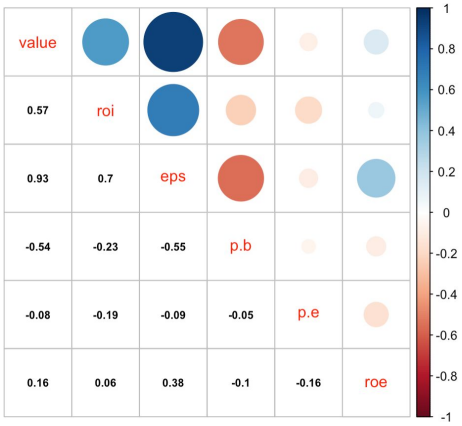
Correlation plots

Apple

One can observe the strongest correlation between brand value and EPS - 0.99.
ROE is also quite strongly correlated with BV.

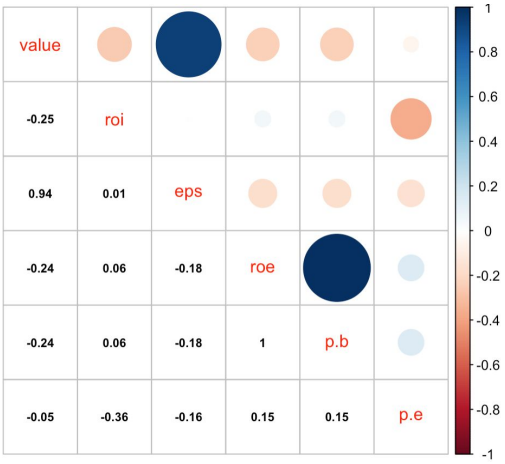
Starbucks

Between EPS and BV there is correlation 0.93, the strongest one among all.



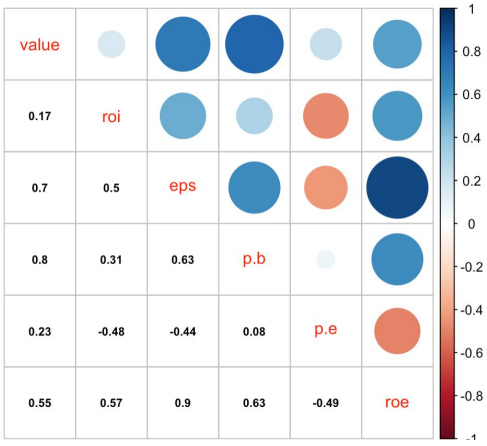
Amazon

Between EPS and BV there is strong Positive correlation = 0.94.
Also, P/B and BV are positively correlated.



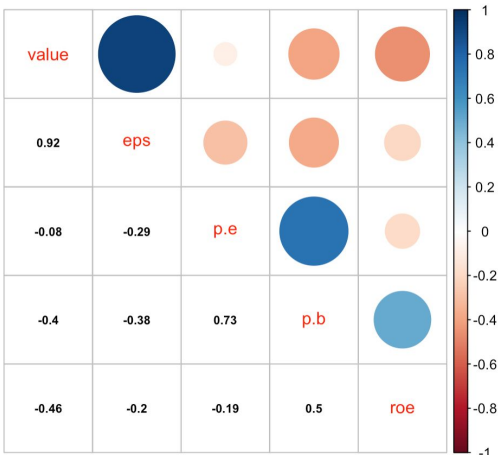
IBM

Again, we observe strong correlation between EPS and BV corr=0.7. Also, strong correlation is Between P/B and BV.



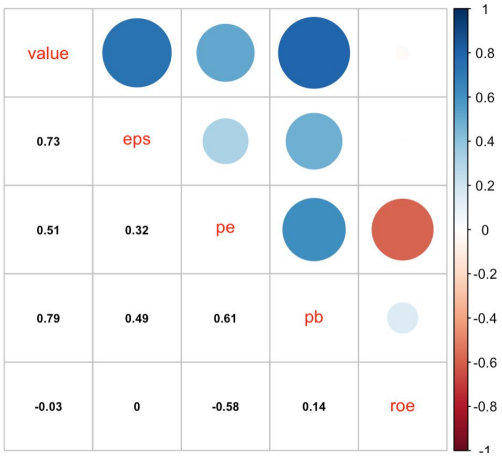
Google

Strongest correlation is between EPS and BV, cor = 0.92



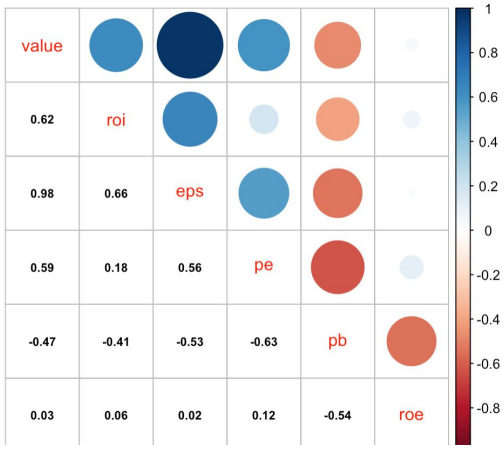
Microsoft

Two variables have strong positive correlation with Brand value - EPS P/B



McDonald's

The strongest correlation is between EPS and BV = 0.92



Regressions

Apple

```
t test of coefficients:

                      Estimate Std. Error t value  Pr(>|t|)
(Intercept)          -0.9895110  0.3111790 -3.1799  0.007923 **
aapl$`Value (in $m)`  0.0412680  0.0013195 31.2764 7.183e-13 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Summary after correcting for heteroskedasticity. β_1 =0.0412680 (the same as in the uncorrected version)
P-value is <0.05, so the variable is statistically significant.
We reject H0.

Starbucks

```
t test of coefficients:

                       Estimate Std. Error t value  Pr(>|t|)
(Intercept)           -0.739157   0.236106 -3.1306  0.008682 **
strbx$`Value (in $m)`  0.345695   0.044285  7.8062 4.828e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

There is summary for corrected OLS.
value variable is also statistically significant with coefficient 0.345695.
Reject H0.

Amazon

```
t test of coefficients:

                       Estimate Std. Error t value  Pr(>|t|)
(Intercept)          -1.4383772  0.7304519 -1.9692   0.07246 .
amzn$`Value (in $m)`  0.0784796  0.0081522  9.6268 5.393e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Due to the low p-value we can see that *value* is is statistically significant.
Reject H0.

IBM

```
t test of coefficients:

                     Estimate Std. Error t value  Pr(>|t|)
(Intercept)         4.278041   0.987308  4.3330 0.0009735 ***
ibm$`Value (in $m)` 0.076367   0.016622  4.5943 0.0006169 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Summary after correcting for heteroskedasticity. β_1 =0.076367
P-value is <0.05, so the variable is statistically significant.
We reject H0.

Google

```
                      Estimate Std. Error t value  Pr(>|t|)
(Intercept)          -2.141150   2.350722 -0.9108    0.3803
goog$`Value (in $m)`  0.140832   0.021417  6.5756 2.629e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Coefficient is also positive and statistically significant.

Microsoft

```
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)           0.9957367  0.4433006  2.2462  0.04430 *
mcrsft$`Value (in $m)` 0.0125319  0.0048978  2.5587  0.02506 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

In Microsoft we see that variable has higher p-value than in the other companies, but still it is small and significant.
Reject H0.

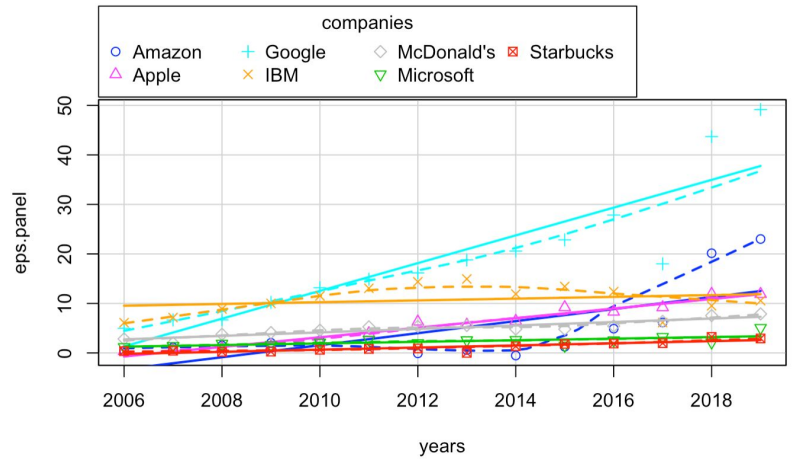
McDonald’s

```
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)           0.7970164  0.3663375  2.1756  0.05029 .
mcdon$`Value (in $m)` 0.0527802  0.0039048 13.5169 1.27e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

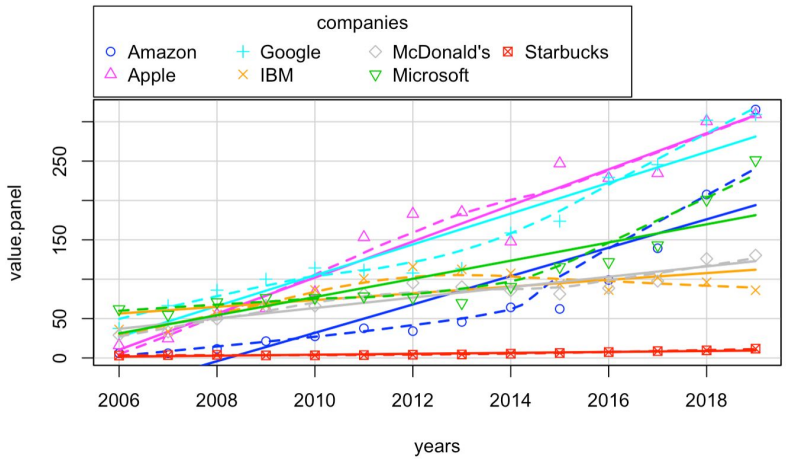
There is summary for corrected OLS.
value variable is statistically significant with coefficient 0.0527802.
Reject H0.

Panel data plots

-plot for EPS



-plot for brand value



Pooled OLS

Before correcting for heteroskedasticity

```
Coefficients:
                  Estimate Std. Error t-value  Pr(>|t|)
(Intercept)       0.1060096  0.9450327  0.1122    0.9109
panel$value.panel 0.0723955  0.0076194  9.5014 1.753e-15 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Here we have statistically significant *value* ,but biased standard errors.

```
        studentized Breusch-Pagan test

data:  brand.pooled
BP = 34.686, df = 1, p-value = 3.875e-09
```

There is homoscedasticity, because p-value<0.05

So, I make robust pooled OLS

```
t test of coefficients:

                  Estimate Std. Error t value Pr(>|t|)
(Intercept)       0.106010   1.574875  0.0673 0.946472
panel$value.panel 0.072396   0.026621  2.7195 0.007761 **
---
```

The *value* variable is statistically significant.

I conduct, that there is an impact of brand value on EPS in panel data.

Fixed effect model

```
t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
value.panel 0.0719495  0.0040608  17.718 < 2.2e-16 ***
---
```

Here we observe also statistical significance = relationship between value and EPS, even after eliminating the unobserved factors.

Random effect model

Assuming we have stochastic unobserved factor, the RE regression gives:

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.1060096  0.2409641  0.4399    0.661
value.panel 0.0723955  0.0043596 16.6058   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Almost the same coefficient as in FE model. Also, statistically significant.

First difference model

Elimination the unobserved factor with FD model gives also statistically significant result,with $\beta_1 = 0.046$

```
Coefficients:
             Estimate Std. Error t-value Pr(>|t|)
(Intercept) -0.015798   1.030089 -0.0153 0.987801
value.panel  0.046330   0.013078  3.5425 0.000657 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

References

1) https://www.investopedia.com/terms/p/price-earningsratio.asp
2) Starbucks Data https://www.macrotrends.net/stocks/charts/SBUX/starbucks/pe-ratio
3) Apple Data https://www.macrotrends.net/stocks/charts/AAPL/apple/revenue
4) Google Data https://www.macrotrends.net/stocks/charts/GOOGL/alphabet/revenue
5) Amazon Data https://www.macrotrends.net/stocks/charts/AMZN/amazon/revenue
6) IBM Data https://www.macrotrends.net/stocks/charts/IBM/ibm/revenue
7) McDonald's Data https://www.macrotrends.net/stocks/charts/MCD/mcdonalds/revenue
8) Microsoft Data https://www.macrotrends.net/stocks/charts/MSFT/microsoft/revenue