Analytics in Managerial Economics

Estimating the effect of a Banking Regulation

Submitted By

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1. Executive Summary

1.1 Abstract

This report focuses on estimating the announcement effect of **Volcker Rule** in reducing **Trading Asset Ratio** of Bank Holding Companies (BHC) with the help of Difference in Differences (DiD) methodology of Study. Timeframe of data used range from 2004, well before inception of VR to 2016 right before VR kicks into effect. Through this report, we aim to gain insights into potential effectiveness of the new regulation and the difference in magnitude of effects across different banks in the industry.

1.2 Key Findings

- Volcker Rule is generally effective in enforcing banks to reduce **Trading Asset**. On average, there is **0.013%** in trading assets across banking industry.

- While the average reduction in trading assets across banking industry is not significant, those affected BHC having greater than **3%** in trading assets before VR have reduced their **TAR** portfolio by **2.33%** more than non-affected BHCs.

- In particular, the **Top 10** banks with highest **TAR** portfolio before the VR announcement have responded strongly by reducing their asset ratio by approx. **6.54%** to the average of **2.33%.** Similar analysis on **Bottom 10** banks has shown a pared down response with only a reduction of **2.11%** to the average of **2.33%.**

- Looking at the overall risk-taking attitude of banks, controversially risk-taking appetite of banks generally **increase** across the industry after announcement of VR, despite **reduction** in trading assets.

1.3 Recommendations

For the regulators, Although **VR** seems to be effective and viable regulation in forcing banks to reduce their **Trading Asset** Portfolio, especially for those **Top performing BHCs** with large trading asset size, they must incorporate more **robust** guideline to recede **general risk-taking** attitude of banks.

Our study has revealed that banks have most likely **shifted** their risk-taking appetite from **proprietary trading** to other **unaffected risky revenue generators**. This will potentially counteract and erode the effectiveness of VR if loosely enforced.

For BHCs with relatively large books, the magnitude of impact is higher than those with smaller **TAR** portfolio. For long term planning, those affected BHCs should transform their business strategically by spreading into **lower risk revenue generators** to buffer the effect, while also remaining competitive during this phase by maintaining their TAR portfolio as nearer to the limit regulated by **VR.**

1.4 Model Feature & Assumptions

- Baseline model is tested for Robustness by taking into account distinct data schema by **Inclusion & Exclusion** of **Fixed Effect** (Both time and Bank), together with other **control variable** (Co-variates).

- **Propensity score matching** methodology is made use to scale down sample Bias problem. We also performed cross validation by choosing dataset spread across three quarter across different years.

- **Placebo Test** is also being accounted for by **randomly** assigning Banks to Control & Treatment group and cross validating our find that, changes occurred in Trading Asset Ratio is primarily due to the announcement of **VR** rule.

- Additional **Hypothesis Testing** is also examined to understand if banks have fundamentally reduced their Risk-taking behavior after the announcement of VR.

2. Baseline Model

We construct a baseline model as below to analyze the change in trading assets ratio (TAR)

$$\mathbf{Y_{i,t}} = \boldsymbol{\alpha} + \boldsymbol{\beta} * \left(\mathbf{after\_DFA_t} * \mathbf{Affected_{BHC_i}}\right) + \boldsymbol{\gamma_i} + \mathbf{X_{i,t}} + \in_{\mathbf{i,t}}$$

$\mathbf{Y_{i,t}}$	Trading asset ratio for the quarter t and bank i	$\boldsymbol{\gamma_i}$	Bank fixed effect
$\mathbf{after\_DFA_t}$	after_DFA=0 if quarter in Q3 2004 to Q2 2009, else 1	$\in_{\mathbf{i,t}}$	Time fixed effect
$\mathbf{treat_{BHC_i}}$	Affected_BHC=1 if the bank was affected, else 0	$\mathbf{X_{i,t}}$	Other Control Variables

We implemented our baseline model with four different variations. Table below shows the results of the regression. Once we control for the Fixed Effects in the model and run test for robustness by running it against several model's forms (such as including/excluding control variables). It is seen that the coefficient β for the interaction term (after_DFA * Affected_BHC) is always **significant**.

Baseline Test Results

	1	2	3	4
Dependent Variable	Trading Asset Ratio			
After_DFA	0.000122	0.00005895	X	X
SD	(0.000139)	(0.0001631)		
Affected_BHC1	0.113 ***	0.1 ***	X	X
SD	(0.000707)	(0.00073)		
After_DFA_11*Affected_BHC1	0.00386 ***	-0.00368 ***	-0.02286 ***	-0.023338 ***
SD	(0.001101)	(0.00107)	(0.0005272)	(0.000528)
Controls	No	Yes	No	Yes
FE	No	No	Yes	Yes
R-squared	0.527	0.5557	0.048563	0.053

3. Robustness Test: Propensity Score Match

We use Propensity Score Matching (**PSM)** to reduce selection bias problem by matching banks with **nearest propensity score** to form **treatment** and **control** group respectively. We have compared **three** different propensity matching approach against the baseline full model.

At first, we matched One treated bank with Three control bank (**1:3**) for **Q3 2004,** followed by matching One treated bank with Five control bank (**1:5**) for **Q3 2004** & **Q2 2009** respectively.

Robustness Test – Propensity Score Match				
	1	2	3	4
Dependent Variable	Full Data	Q3 2004 with 1:3	Q3 2004 with 1:5	Q2 2009 with 1:5
Affected_BHC * After_DFA	**-0.02333*** **	**-0.02767*** **	**-0.02782*** **	**-0.020893*** **
Control variable & Fix Effects	YES	YES	YES	YES
No. of Observations	40026	1668	2690	3295
R-Squared	0.053135	0.18278	0.15674	0.086545

Table 2: Robustness test using propensity score matching

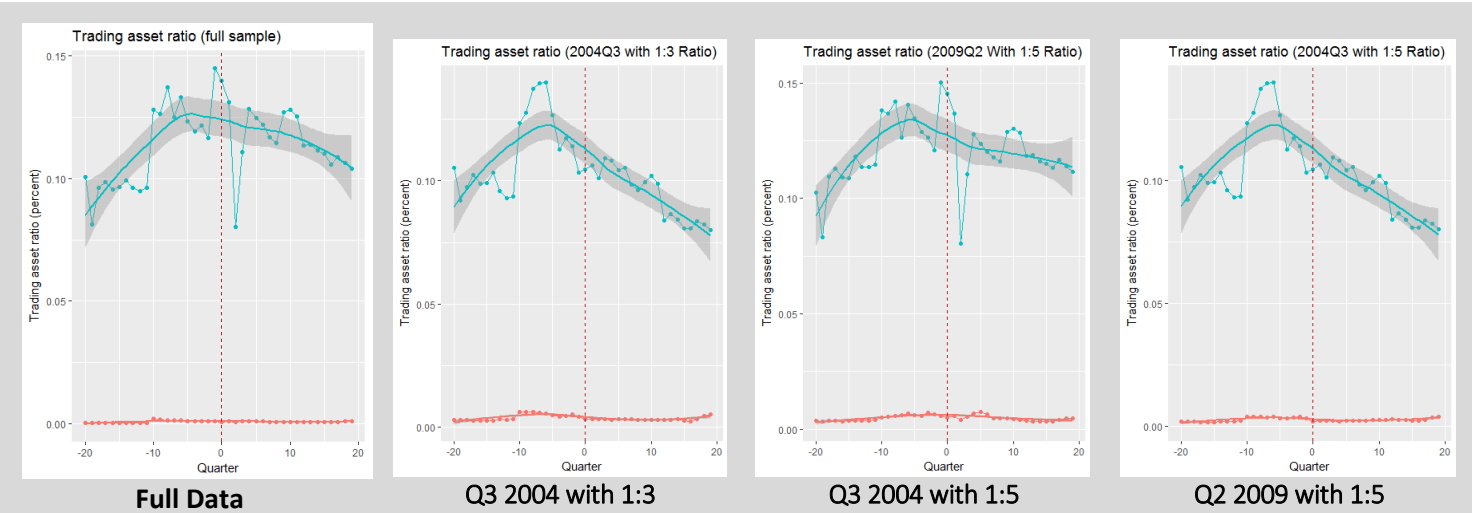


Fig1: Attributes of data for robustness comparisons

As shown in Fig1 and Table2, all our **PSM** models yields are **significant**, and the **coefficient** values are similar, giving a clear indication that the **effect in the outcome is due to treatment effect**. We did also try PSM using **Caliper matching** method. It gives an overall better matched and balanced data, but it resulted in having very few matching group (**6 treatment & 6 control with 1:1 ratio**) as against PSM with '**Nearest**' method (**54 Treatment & 54 Control with 1:1 ratio**)

4. Placebo Test – Exogenous Shocks in the System

To prove that there is an exogenous shock, we have randomly assigned the treatment and control labels to the BHC's in the data set as in the model below. We observe the coefficient for interaction term to be **insignificant**. **Pr (>|t|)** value of interaction term ($\mathbf{after\_DFA_t} * \mathbf{Random_{BHC_i}}$) for each random assignment is shown in appendix.

Hence this indicates that there is an **exogenous shock** in the system driving the trading asset ratios.

$$\mathbf{Y_{i,t}} = \boldsymbol{\alpha} + \boldsymbol{\beta} * (\mathbf{after\_DFA_t} * \mathbf{Random_{BHC_i}}) + \boldsymbol{\gamma_i} + \mathbf{X_{i,t}} + \in_{i,t}$$

5. Top 10 and Bottom 10 group effects

We also divided the Matched dataset (Q3 2004 with 1:3) into 3 groups. Group 1 contained the top 10 banks with the maximum trading asset ratios before the Volcker rule, whereas the rest were in Treatment and Control groups.

$$\mathbf{Y_{i,t}} = \boldsymbol{\alpha} + \boldsymbol{\beta} * (\mathbf{after_{DFA_t}} * \mathbf{Affected_{BHC_i}}) + \boldsymbol{\beta_2} * (\mathbf{top_{10_{players}}} * \mathbf{Affected_{BHC_i}}) \boldsymbol{\gamma_i} + \mathbf{X_{i,t}} + \in_{i,t}$$

Results showed that the **top 10 banks** responded more **significantly** to the Volcker rule by reducing their trading asset ratio by **6.54%** more than non-treated banks and **4.44%** more than the smaller treated bank. This would be because these banks would need to make a significant reduction in their trading asset ratio in compliance with the rule.

Similar analysis on the **Lowest 10 banks** shows that the banks with the lowest (but > 3%) trading asset ratio before the VR reduced their assets by **2.11%** compared to the average of **2.33%**.

6. Additional Hypothesis

The overall effectiveness of VR rule would largely depend on whether banks have fundamentally **reduced risk taking behavior**. To measure this a normalized **Z score** is calculated based on Returns and volatility of returns, whereby **Z-Score = (ROA + Leverage Ratio)/$\boldsymbol{\sigma ROA}$**

Where Return on Asset (**ROA**) and Leverage Ratio or Capital Asset Ratio signifies return on company's risk taking activities and $\boldsymbol{\sigma ROA}$ captures risk taking volatility. Since the term is highly skewed, a natural log transformation is performed and the following model is created:

$$\mathbf{log(Z\_Score)_{i,t}} = \boldsymbol{\alpha} + \boldsymbol{\beta} * (\mathbf{after\_DFA_t} * \mathbf{Random_{BHC_i}}) + \boldsymbol{\gamma_i} + \mathbf{X_{i,t}} + \in_{i,t}$$

Key Finding

- Risk taking appetite represented by $\mathbf{log(Z\_Score)_{i,t}}$ **increases** across BHCs after the announcement of VR and the effect is statistically **significant**, concluding that VR rule has **failed** to decrease Bank's overall Risk Taking greed.

- Comparing affected BHCs with large trading books to those with less affected BHCs by VR, the risk taking appetite **did not** show a **significant deviation**

7. Reference

Keppo J and **Korte J**. Risk Targeting and Policy illusions – Evidence from the Announcement of the Volcker rule
SSRN: http://ssrn.com/abstract=2466477 or http://dx.doi.org/10.2139/ssrn.2466477

Olmos A, **Govindasamy P**, Propensity Scores: A Practical Introduction Using R. Journal of Multidisciplinary Evaluation. Vol 11, Issue 25, 2015. ISSN 1556-8180

8. Appendix

8.1 Baseline Model

```
Call:
plm(formula = TAR ~ Affected_BHC * After_DFA + ROA + Leverage_Ratio +
    Total_Asset + Credit_Risk_Ratio + Cost_Income_Ratio + Deposit_Ratio +
    Real_Estate_Ratio + Liquidity_Ratio + CPP, data = modified_data,
    index = c("id", "Time"))

Unbalanced Panel: n=2428, T=1-38, N=40026

Residuals :
       Min.     1st Qu.      Median     3rd Qu.        Max.
-1.0927e-01 -2.2475e-04 -5.9395e-06  1.8227e-04  1.9179e-01

Coefficients :
                           Estimate  Std. Error  t-value  Pr(>|t|)
After_DFA              -1.3017e-04  9.4527e-05  -1.3771 0.1685049
ROA                    -2.0121e-04  8.0709e-03  -0.0249 0.9801108
Leverage_Ratio          3.2278e-03  1.8475e-03   1.7472 0.0806157 .
Total_Asset             5.0860e-04  1.4875e-04   3.4191 0.0006289 ***
Credit_Risk_Ratio       3.6595e-03  1.2871e-03   2.8431 0.0044705 **
Cost_Income_Ratio       2.0625e-04  1.2907e-04   1.5981 0.1100376
Deposit_Ratio           1.5023e-03  5.4999e-04   2.7315 0.0063071 **
Real_Estate_Ratio      -8.3544e-03  6.7402e-04 -12.3948 < 2.2e-16 ***
Liquidity_Ratio        -6.0897e-04  1.0169e-03  -0.5988 0.5492936
CPP                    -1.2342e-04  1.4752e-04  -0.8366 0.4028371
Affected_BHC:After_DFA -2.3327e-02  5.2805e-04 -44.1755 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    1.2613
Residual Sum of Squares: 1.1943
R-Squared:      0.053135
Adj. R-Squared: -0.0082813
F-statistic: 191.751 on 11 and 37587 DF, p-value: < 2.22e-16
```

8.2 Propensity Score Matching - Q3 2004 with 1:3

```
Call:
plm(formula = TAR ~ Affected_BHC * After_DFA + ROA + Leverage_Ratio +
    Total_Asset + Credit_Risk_Ratio + Cost_Income_Ratio + Deposit_Ratio +
    Real_Estate_Ratio + Liquidity_Ratio, data = matched_data_1,
    index = c("id", "Time"))

Unbalanced Panel: n=72, T=1-38, N=1668

Residuals :
       Min.     1st Qu.      Median     3rd Qu.        Max.
-0.11004955 -0.00387388 -0.00017831  0.00294318  0.18773522

Coefficients :
                           Estimate  Std. Error  t-value  Pr(>|t|)
After_DFA              -0.00160454  0.00141700  -1.1324 0.2576568
ROA                    -0.11610932  0.13548400  -0.8570 0.3915763
Leverage_Ratio          0.06489552  0.03091499   2.0992 0.0359605 *
Total_Asset            -0.01073257  0.00232409  -4.6180 4.188e-06 ***
Credit_Risk_Ratio       0.09322868  0.02403835   3.8783 0.0001095 ***
Cost_Income_Ratio       0.00095541  0.00087817   1.0879 0.2767832
Deposit_Ratio           0.02269132  0.00740090   3.0660 0.0022059 **
Real_Estate_Ratio      -0.09148019  0.00950275  -9.6267 < 2.2e-16 ***
Liquidity_Ratio        -0.05079442  0.01413619  -3.5932 0.0003366 ***
Affected_BHC:After_DFA -0.02767667  0.00218465 -12.6687 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    0.48571
Residual Sum of Squares: 0.39694
R-Squared:      0.18278
Adj. R-Squared: 0.14104
F-statistic: 35.4722 on 10 and 1586 DF, p-value: < 2.22e-16
```

8.3 **Propensity Score Matching** - Q3 2004 with 1:5

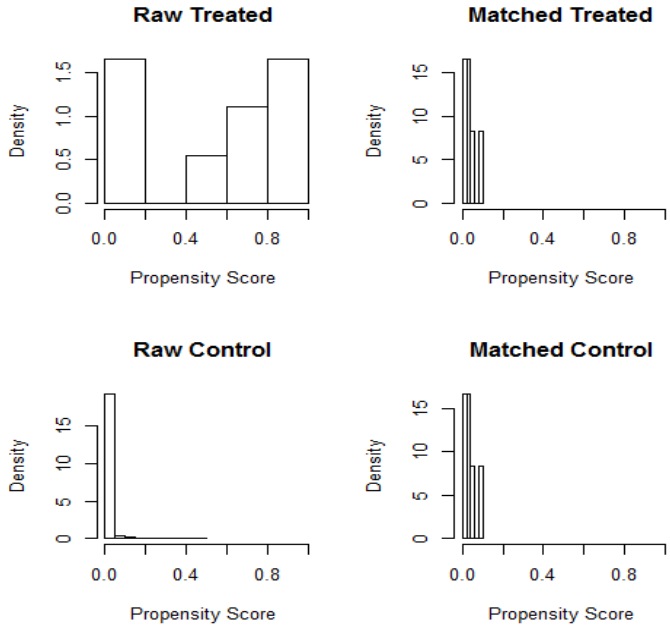
```
Call:
plm(formula = TAR ~ Affected_BHC * After_DFA + ROA + Leverage_Ratio +
    Total_Asset + Credit_Risk_Ratio + Cost_Income_Ratio + Deposit_Ratio +
    Real_Estate_Ratio + Liquidity_Ratio, data = matched_data_3,
    index = c("id", "Time"))

Unbalanced Panel: n=108, T=1-38, N=2690

Residuals :
       Min.     1st Qu.      Median     3rd Qu.        Max.
-0.10986031 -0.00243204 -0.00010616  0.00202371  0.18927858

Coefficients :
                          Estimate  Std. Error  t-value  Pr(>|t|)
After_DFA              -0.00031270  0.00085693  -0.3649  0.715214
ROA                    -0.13467004  0.08986698  -1.4985  0.134113
Leverage_Ratio          0.05847152  0.01943044   3.0093  0.002644 **
Total_Asset            -0.00815321  0.00143717  -5.6731 1.559e-08 ***
Credit_Risk_Ratio       0.06416195  0.01516229   4.2317 2.401e-05 ***
Cost_Income_Ratio       0.00062888  0.00059464   1.0576  0.290349
Deposit_Ratio           0.01111656  0.00491342   2.2625  0.023750 *
Real_Estate_Ratio      -0.05469056  0.00557795  -9.8048 < 2.2e-16 ***
Liquidity_Ratio        -0.03668125  0.00889303  -4.1247 3.830e-05 ***
Affected_BHC:After_DFA -0.02782090  0.00166286 -16.7307 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    0.49541
Residual Sum of Squares: 0.41776
R-Squared:      0.15674
Adj. R-Squared: 0.11838
F-statistic: 47.807 on 10 and 2572 DF, p-value: < 2.22e-16
```

8.4 **Propensity Score Matching** - Q2 2009 with 1:5

```
Call:
plm(formula = TAR ~ Affected_BHC * After_DFA + ROA + Leverage_Ratio +
    Total_Asset + Credit_Risk_Ratio + Cost_Income_Ratio + Deposit_Ratio +
    Real_Estate_Ratio + Liquidity_Ratio, data = matched_data_2,
    index = c("id", "Time"))

Unbalanced Panel: n=102, T=6-38, N=3295

Residuals :
       Min.     1st Qu.      Median     3rd Qu.        Max.
-0.07599745 -0.00223607 -0.00014941  0.00165545  0.17971603

Coefficients :
                          Estimate  Std. Error  t-value  Pr(>|t|)
After_DFA              -0.00131174  0.00072307  -1.8141 0.0697541 .
ROA                    -0.05038298  0.06752464  -0.7461 0.4556367
Leverage_Ratio          0.00505930  0.01343592   0.3766 0.7065329
Total_Asset             0.00108895  0.00105045   1.0366 0.2999785
Credit_Risk_Ratio       0.06029308  0.01377620   4.3766 1.244e-05 ***
Cost_Income_Ratio       0.00071851  0.00065952   1.0894 0.2760453
Deposit_Ratio           0.01434226  0.00381695   3.7575 0.0001747 ***
Real_Estate_Ratio      -0.00552953  0.00459356  -1.2038 0.2287735
Liquidity_Ratio        -0.00665598  0.00608909  -1.0931 0.2744330
Affected_BHC:After_DFA -0.02089358  0.00139479 -14.9797 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    0.62733
Residual Sum of Squares: 0.57304
R-Squared:      0.086545
Adj. R-Squared: 0.05469
F-statistic: 30.157 on 10 and 3183 DF, p-value: < 2.22e-16
```

8.5 **Propensity Score Matching –** Caliper Matching

```
Call:
matchit(formula = treat ~ X, data = data2, method = "nearest",
    caliper = 0.25 * ps.sd)

Sample sizes:
          Control Treated
All           783      18
Matched         6       6
Unmatched     777      12
Discarded       0       0
```



8.6 **Propensity Score Matching –** Used Model

```
Call:
matchit(formula = treat ~ X, data = data2, method = "nearest",
    ratio = 3)

Sample sizes:
          Control Treated
All           783      18
Matched        54      18
Unmatched     729       0
Discarded       0       0
```

8.7 Model for Placebo Test

```
Call:
plm(formula = TAR ~ random_BHC * After_DFA + ROA + Leverage_Ratio +
    Total_Asset + Credit_Risk_Ratio + Cost_Income_Ratio + Deposit_Ratio +
    Real_Estate_Ratio + Liquidity_Ratio + CPP, data = modified_data,
    model = "within", index = c("id", "Time"))

Unbalanced Panel: n=2428, T=1-38, N=40026

Residuals :
       Min.     1st Qu.      Median     3rd Qu.        Max.
-0.10925732 -0.00026096 -0.00001302  0.00020608  0.19182712

Coefficients :
                       Estimate  Std. Error t-value  Pr(>|t|)
random_BHC           -3.2549e-05  7.6888e-05 -0.4233 0.6720562
After_DFA            -4.2909e-04  1.1451e-04 -3.7472 0.0001791 ***
ROA                  -3.0634e-03  8.2776e-03 -0.3701 0.7113213
Leverage_Ratio        3.2098e-03  1.8949e-03  1.6940 0.0902810 .
Total_Asset           4.6415e-04  1.5257e-04  3.0422 0.0023499 **
Credit_Risk_Ratio     4.1635e-03  1.3201e-03  3.1538 0.0016127 **
Cost_Income_Ratio     1.0254e-04  1.3235e-04  0.7747 0.4384930
Deposit_Ratio         7.2058e-04  5.6381e-04  1.2781 0.2012390
Real_Estate_Ratio    -6.4014e-03  6.8982e-04 -9.2798 < 2.2e-16 ***
Liquidity_Ratio      -2.3995e-03  1.0422e-03 -2.3023 0.0213258 *
CPP                   7.4548e-06  1.5129e-04  0.0493 0.9607006
random_BHC:After_DFA -3.2328e-05  1.2166e-04 -0.2657 0.7904525
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    1.2613
Residual Sum of Squares: 1.2563
R-Squared:      0.0039921
Adj. R-Squared: -0.06064
F-statistic: 12.554 on 12 and 37586 DF, p-value: < 2.22e-16
```

The **p-values** for the coefficient of the interaction term were found to be **insignificant** (**at 95% confidence level**) for 10 random assignments, as shown in the table below:

Test Num	1	2	3	4	5	6	7	8	9	10
Pr (>|t|)	0.7427	0.1865	0.3449	0.7052	0.9436	0.9156	0.8002	0.8771	0.7034	0.8498

Table: Pr (>|t|) value for Interaction term for each Random Assignment

8.8 Top Ten Grouping Effect

```
Call:
plm(formula = TAR ~ (After_DFA * top10) + (After_DFA * Affected_BHC) +
    ROA + Leverage_Ratio + Total_Asset + Credit_Risk_Ratio +
    Cost_Income_Ratio + Deposit_Ratio + Real_Estate_Ratio + Liquidity_Ratio +
    CPP, data = top10AnalysisData, index = c("id", "Time"))

Unbalanced Panel: n=72, T=1-38, N=1668

Residuals :
       Min.     1st Qu.      Median     3rd Qu.        Max.
-0.10990032 -0.00373428 -0.00027249  0.00271573  0.18809633

Coefficients :
                        Estimate Std. Error t-value  Pr(>|t|)
After_DFA              -0.0020446  0.0013900 -1.4709 0.1415122
ROA                    -0.0618440  0.1329178 -0.4653 0.6417946
Leverage_Ratio          0.0409597  0.0310584  1.3188 0.1874274
Total_Asset            -0.0073540  0.0023199 -3.1700 0.0015534 **
Credit_Risk_Ratio       0.1080443  0.0242669  4.4523 9.089e-06 ***
Cost_Income_Ratio       0.0008210  0.0008607  0.9539 0.3402922
Deposit_Ratio           0.0179697  0.0072786  2.4688 0.0136599 *
Real_Estate_Ratio      -0.0877978  0.0093267 -9.4136 < 2.2e-16 ***
Liquidity_Ratio        -0.0474955  0.0138720 -3.4238 0.0006332 ***
CPP                    -0.0014370  0.0016478 -0.8721 0.3832985
After_DFA:top10        -0.0444711  0.0057430 -7.7435 1.714e-14 ***
After_DFA:Affected_BHC -0.0210457  0.0023167 -9.0843 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    0.48571
Residual Sum of Squares: 0.38055
R-Squared:      0.21652
Adj. R-Squared: 0.17547
F-statistic: 36.4801 on 12 and 1584 DF, p-value: < 2.22e-16
```

8.9 Additional Hypothesis

The regression model and summary results of for the additional hypothesis testing is shown below.

Where: Z_Score_Log = log((ROA + Leverage Ratio)/σROA)
σROA is computed from 10 quarters ROA with moving window approach

Coefficient of After_DFA is positive and highly statistically significant, implying that BHCs in general increased risk appetite after VR announcement.

Coefficient of Affected BHC:After_DFA is positive but not statistically significant, implying that risk attitude of BHCs with large trading book is not significantly different from those with small trading books.

```
Call:
plm(formula = Z_Score_log ~ Affected_BHC * After_DFA + TAR +
    Total_Asset + Credit_Risk_Ratio + Cost_Income_Ratio + Deposit_Ratio +
    Real_Estate_Ratio + Liquidity_Ratio + CPP, data = data1,
    index = c("id", "Time"))

Unbalanced Panel: n=2107, T=1-38, N=34353

Residuals :
     Min.   1st Qu.    Median   3rd Qu.      Max.
-7.720029 -0.378699 -0.010727  0.360137  5.043606

Coefficients :
                         Estimate Std. Error  t-value  Pr(>|t|)
After_DFA                0.8685200  0.0127977  67.8655 < 2.2e-16 ***
TAR                     -3.0348504  0.6989585  -4.3420 1.416e-05 ***
Total_Asset             -0.4771253  0.0211862 -22.5206 < 2.2e-16 ***
Credit_Risk_Ratio       -8.2800229  0.1947136 -42.5241 < 2.2e-16 ***
Cost_Income_Ratio       -0.0754841  0.0176421  -4.2786 1.886e-05 ***
Deposit_Ratio           -0.7329130  0.0758512  -9.6625 < 2.2e-16 ***
Real_Estate_Ratio       -1.8582113  0.0962177 -19.3126 < 2.2e-16 ***
Liquidity_Ratio         -0.3861293  0.1450226  -2.6625  0.007759 **
CPP                      0.0069822  0.0200449   0.3483  0.727596
Affected_BHC:After_DFA   0.0279716  0.0726555   0.3850  0.700248
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    20197
Residual Sum of Squares: 16628
R-Squared:      0.1767
Adj. R-Squared: 0.12266
F-statistic: 691.871 on 10 and 32236 DF, p-value: < 2.22e-16
```

**********END**********