TBM

Mostafa Kamal

2023-05-21

Contents

loading the data

```
# library()

library(readxl)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.0      v purrr   1.0.1
## v tibble  3.1.8      v dplyr   1.1.0
## v tidyr   1.3.0      v stringr 1.5.0
## v readr   2.1.3      v forcats 1.0.0
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(stargazer)
```

```
##
## Please cite as:
##
##  Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables.
##  R package version 5.2.3. https://CRAN.R-project.org/package=stargazer
```

```
library(ggplot2)
library(plm)
```

```
## Warning: package 'plm' was built under R version 4.2.3
```

```
##
## Attaching package: 'plm'
##
## The following objects are masked from 'package:dplyr':
##
##     between, lag, lead
```

```
library(urca)
```

```
## Warning: package 'urca' was built under R version 4.2.3
```

```
# loading the data and grooming the data
data <- read_excel("Data for analysis.xlsx",
                                    sheet = "Final",
                                    col_types = c(rep("text",5), rep('numeric',32)))
data <- as.data.frame(na.omit(data))
```
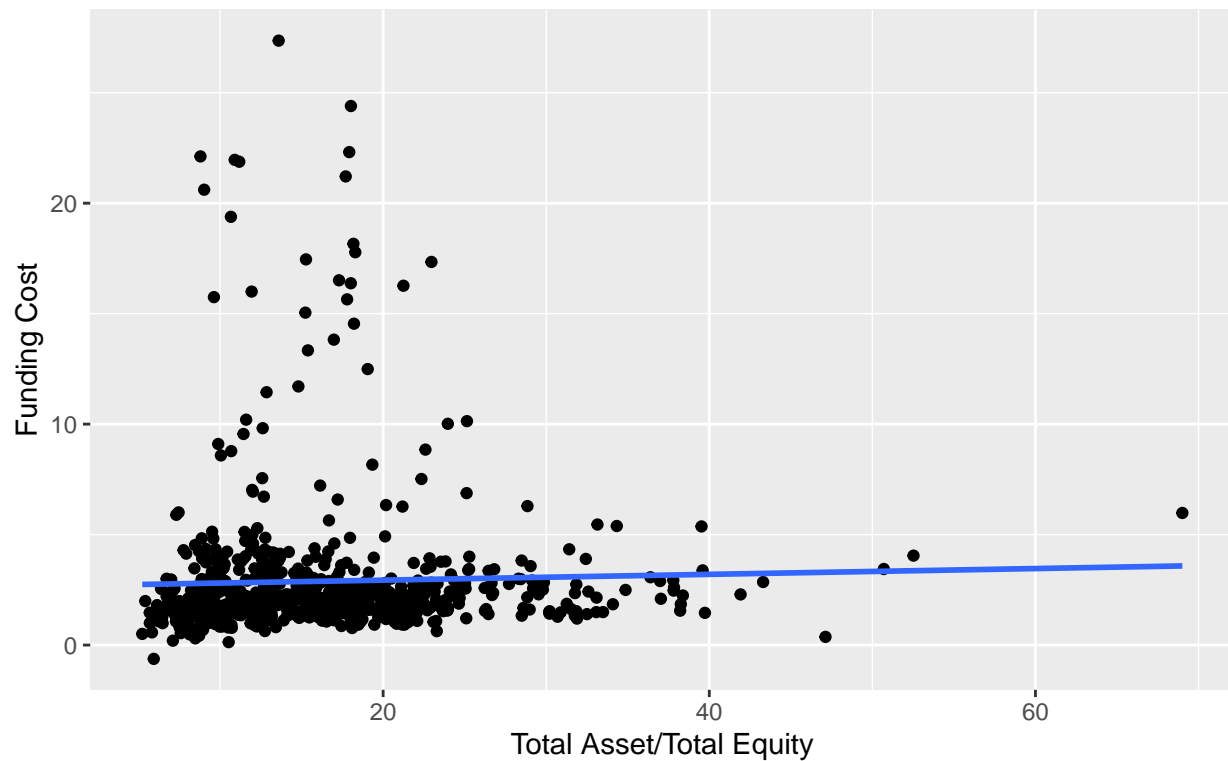
Preparing the initial graphs

```
# 1st one -----------------------------------------------------------------

# for all

data %>%
  #group_by(countryOfOrigin) %>%
  ggplot(mapping = aes(x=TA_TE, y=FundingCost))+
  geom_point()+
  geom_smooth(method = 'lm', se=FALSE)+
  #facet_wrap(facets = ~countryOfOrigin, scales = 'free_y', ncol = 2)+
  labs(title = "Cost of Debt Funding",
       # subtitle = "Categories are based on bank regions",
       caption = "Data source: Bloomberg") +
  xlab('Total Asset/Total Equity') + ylab('Funding Cost')+
  theme(legend.position = 'none',
        plot.caption = element_text(hjust = 0))
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

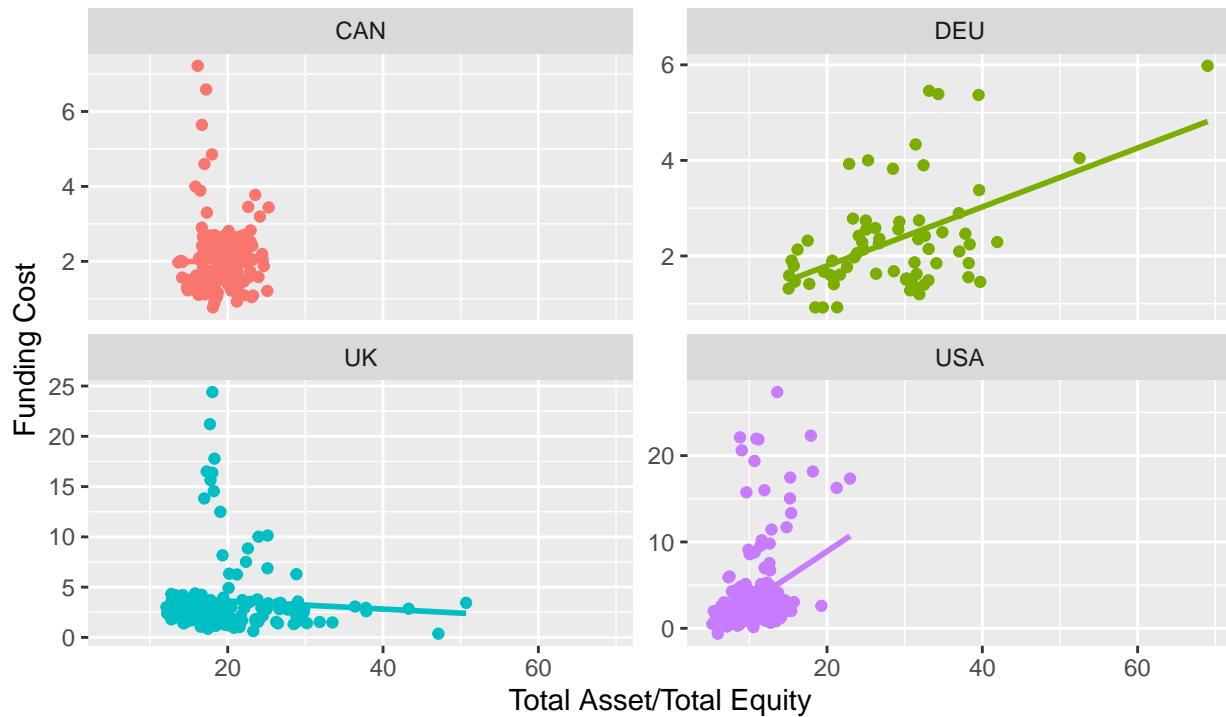# Cost of Debt Funding

Data source: Bloomberg

```
# for country wise

data %>%
  group_by(countryOfOrigin) %>%
  ggplot(mapping = aes(x=TA_TE, y=FundingCost,col=countryOfOrigin))+
  geom_point()+
  geom_smooth(method = 'lm', se=FALSE)+
  facet_wrap(facets = ~countryOfOrigin, scales = 'free_y', ncol = 2)+
  labs(title = "Cost of Debt Funding",
       subtitle = "Categories are based on bank regions",
       caption = "Data source: Bloomberg") +
  xlab('Total Asset/Total Equity') + ylab('Funding Cost')+
  theme(legend.position = 'none',
        plot.caption = element_text(hjust = 0))
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

Cost of Debt Funding
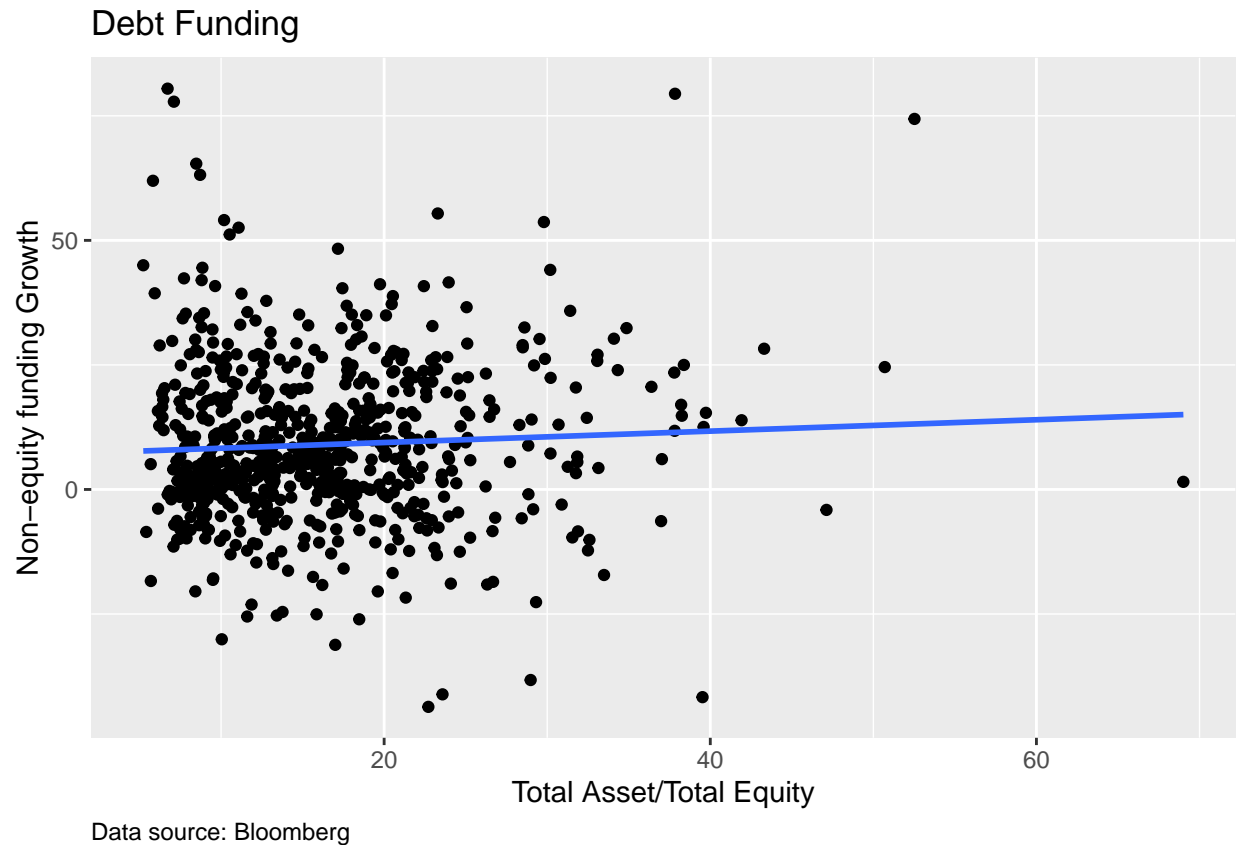
Categories are based on bank regions

Data source: Bloomberg

```
# 2nd one ------------------------------------------------------------------

# for all

data %>%
  # group_by(countryOfOrigin) %>%
  ggplot(mapping = aes(x=TA_TE, y=TFundGrow))+
  geom_point()+
  geom_smooth(method = 'lm', se=FALSE)+
  # facet_wrap(facets = ~countryOfOrigin, scales = 'free_y', ncol = 2)+
  labs(title = "Debt Funding",
       # subtitle = "Categories are based on bank regions",
       caption = "Data source: Bloomberg") +
  xlab('Total Asset/Total Equity') + ylab('Non-equity funding Growth')+
  theme(legend.position = 'none',
        plot.caption = element_text(hjust = 0))
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

Debt Funding

Data source: Bloomberg

```
# for country wise

data %>%
  group_by(countryOfOrigin) %>%
  ggplot(mapping = aes(x=TA_TE, y=TFundGrow,col=countryOfOrigin))+
  geom_point()+
  geom_smooth(method = 'lm', se=FALSE)+
  facet_wrap(facets = ~countryOfOrigin, scales = 'free_y', ncol = 2)+
  labs(title = "Debt Funding",
       subtitle = "Categories are based on bank regions",
       caption = "Data source: Bloomberg") +
  xlab('Total Asset/Total Equity') + ylab('Non-equity funding Growth')+
  theme(legend.position = 'none',
        plot.caption = element_text(hjust = 0))
```

```
## 'geom_smooth()' using formula = 'y ~ x'
```

Debt Funding
Categories are based on bank regions

Data source: Bloomberg

```
# 3rd --------------------------------------------------------------------------

# for all()

data %>%
  # group_by(countryOfOrigin) %>%
  ggplot(mapping = aes(x=TA_TE, y=LG))+
  geom_point()+
  geom_smooth(method = 'lm', se=FALSE)+
  # facet_wrap(facets = ~countryOfOrigin, scales = 'free_y', ncol = 2)+
  labs(title = "Lending",
       # subtitle = "Categories are based on bank regions",
       caption = "Data source: Bloomberg") +
  xlab('Total Asset/Total Equity') + ylab('Non-equity Financing Growth')+
  theme(legend.position = 'none',
        plot.caption = element_text(hjust = 0))
```
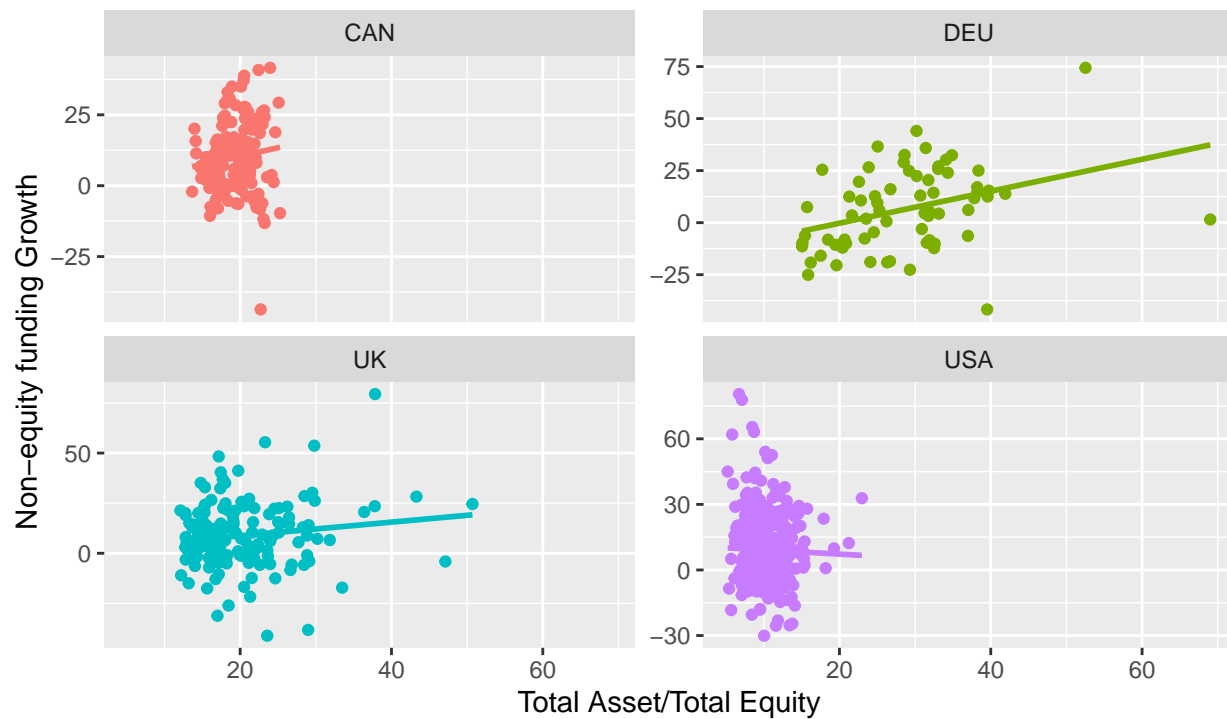
```
## `geom_smooth()` using formula = 'y ~ x'
```

Lending

Data source: Bloomberg

```r
# for country wise

data %>%
  group_by(countryOfOrigin) %>%
  ggplot(mapping = aes(x=TA_TE, y=LG,col=countryOfOrigin))+
  geom_point()+
  geom_smooth(method = 'lm', se=FALSE)+
  facet_wrap(facets = ~countryOfOrigin, scales = 'free_y', ncol = 2)+
  labs(title = "Lending",
       subtitle = "Categories are based on bank regions",
       caption = "Data source: Bloomberg") +
  xlab('Total Asset/Total Equity') + ylab('Non-equity Financing Growth')+
  theme(legend.position = 'none',
        plot.caption = element_text(hjust = 0))
```

```
## 'geom_smooth()' using formula = 'y ~ x'
```
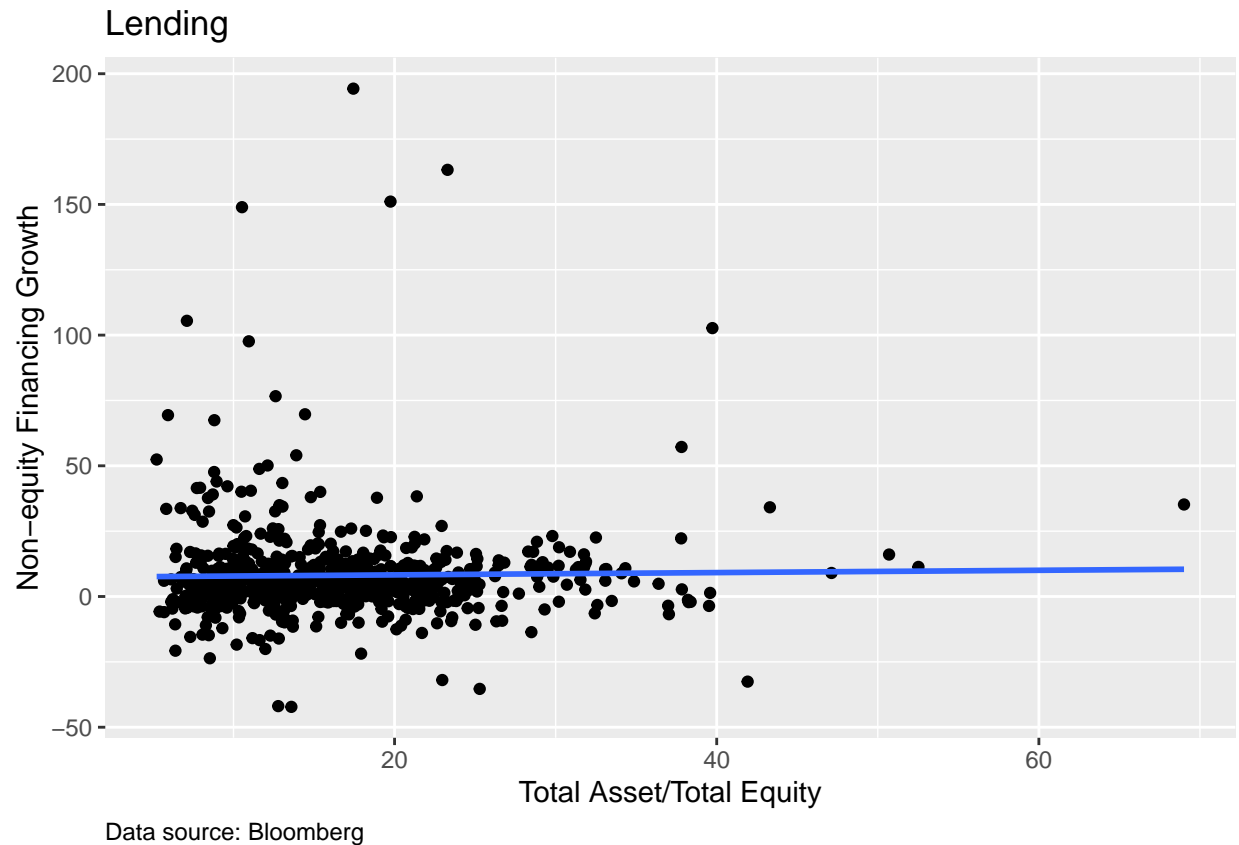
Lending

Categories are based on bank regions
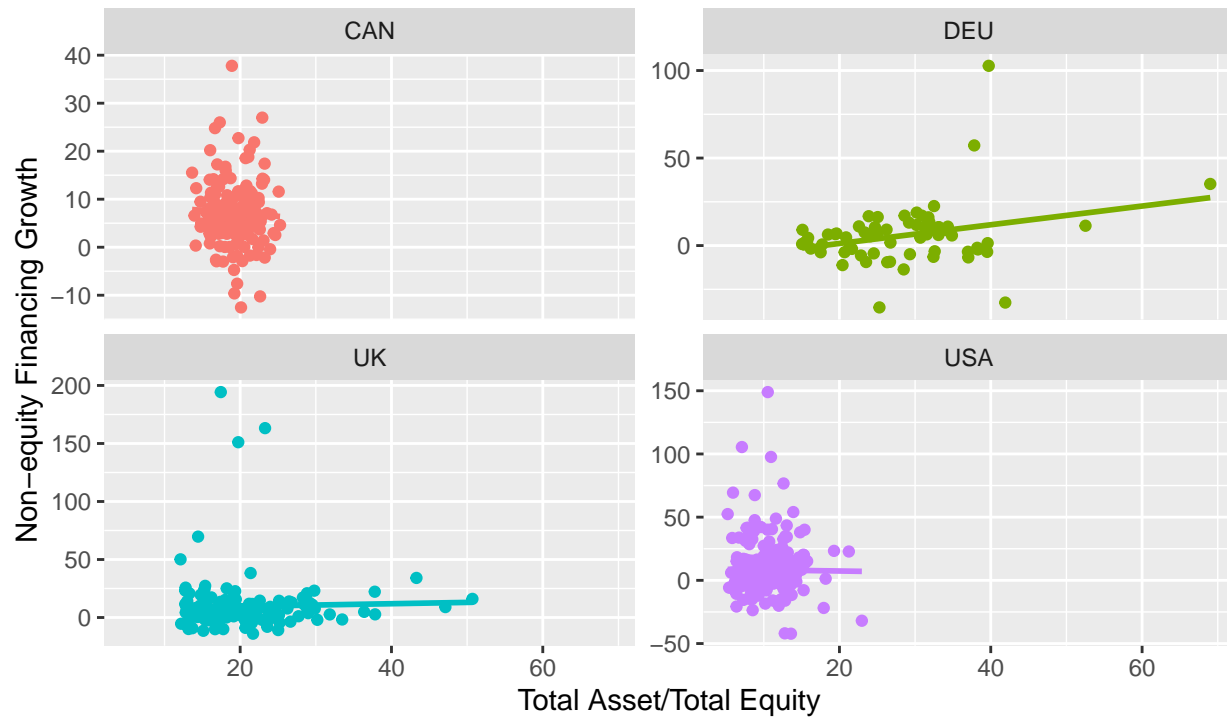
Data source: Bloomberg

Summary statistics

```
# High Levered and low levered banks and their summary stats

# summary statistics for the banks (need to add all the variables)

leverdUnleverd <- data %>%
  group_by(bankName) %>%
  summarise(
    N = n(),
    Min = min(TA_TE),
    Mean = mean(TA_TE),
    q1 = quantile(TA_TE,probs = 0.25),
    Median = median(TA_TE),
    q3 = quantile(TA_TE,probs = 0.75),
    Max = max(TA_TE))


# 1st and 4th quantile of the overall asset/equity

data %>%
  summarise(
    quantile = quantile(TA_TE, probs = c(0.25,0.75))
```

```
  )
```

```
## Warning: Returning more (or less) than 1 row per `summarise()` group was deprecated in
## dplyr 1.1.0.
## i Please use `reframe()` instead.
## i When switching from `summarise()` to `reframe()`, remember that `reframe()`
##    always returns an ungrouped data frame and adjust accordingly.
```

```
##    quantile
## 1  10.1107
## 2  20.1072
```

```r
# finding the levered and unlevered firms

leverdUnleverd %>%
  filter(q1<=10.11 | q1>=20.12) %>%
  arrange(q1)
```

```
## # A tibble: 14 x 8
##     bankName                 N   Min  Mean    q1 Median    q3   Max
##     <chr>                 <int> <dbl> <dbl> <dbl>  <dbl> <dbl> <dbl>
##  1 Santander Holdings        24  5.23  8.88  6.33   8.40 11.8  13.9
##  2 Capial One Financial      24  5.82  7.27  6.65   7.11  7.67  9.63
##  3 Truist Financial          24  7.11  9.26  7.68   9.21 10.4  13.0
##  4 M&T Bank                  24  7.30  8.85  7.82   8.69  9.46 12.5
##  5 PNC                       24  7.27  8.92  7.96   8.53 10.0  12.2
##  6 Fifth Third Bancorp       24  7.88  9.47  8.82   8.95 10.1  12.1
##  7 Bank of New York Mellon   24  6.72  9.72  8.90   9.83 10.3  12.8
##  8 KeyCorp                   24  8.07 10.6   8.94   9.72 12.5  14.1
##  9 Bank of America           24  8.22 10.7   9.15  10.3  11.9  15.0
## 10 US Bancorp                24  8.71 10.0   9.30  10.0  10.4  13.2
## 11 Citigroup Inc             24  7.76 11.6   9.75  11.7  12.7  19.3
## 12 Commerzbank               34 15.1  28.0  20.5   30.8  32.6  41.9
## 13 Barclays                  34 17.0  24.6  20.5   23.6  26.8  43.3
## 14 Deutsche Bank             33 18.5  29.6  23.3   26.2  33.1  69.0
```

```r
# partioning the data in the highly levered and lower levered dataset

dataHL <- data %>%
  # select(bankName, Year, LL, HL) %>%
  mutate(
    LL = case_when(
      bankName== "Santander Holdings"~1,
      bankName== "Capial One Financial"~1,
      bankName== "Truist Financial"~1,
      bankName== "M&T Bank"~1,
      bankName== "PNC"~1,
      bankName== "Fifth Third Bancorp"~1,
      bankName== "Bank of New York Mellon"~1,
      bankName== "KeyCorp"~1,
      bankName== "Bank of America"~1,
      bankName== "US Bancorp"~1,
```

```
      bankName== "Citigroup Inc"~1,
      TRUE ~ 0),
    HL = case_when(
      bankName== "Barclays"~1,
      bankName== "Commerzbank"~1,
      bankName== "Deutsche Bank"~1,
      TRUE ~ 0))

dataHL %>%
  # group_by(LL,HL) %>%
  filter(HL==1 | LL==1) %>%
  group_by(LL,HL) %>%
  summarise(
    obs=n(),
    assets=mean(TA/1000),
    costOfDebtFinancing = mean(FundingCost),
    growthRateOfDebtFinancing =mean(TFundGrow),
    growthRateOfLending = mean(LG),
    assetRisk = sd(TA/1000),
    ROA = mean(ROA))%>%
  t() %>%
  round(digits = 3)
```

```
## 'summarise()' has grouped output by 'LL'. You can override using the '.groups'
## argument.
```

```
##                             [,1]    [,2]
## LL                          0.000   1.000
## HL                          1.000   0.000
## obs                       101.000 264.000
## assets                   1037.813 479.356
## costOfDebtFinancing         2.276   2.083
## growthRateOfDebtFinancing   7.266   9.364
## growthRateOfLending         5.856   8.222
## assetRisk                 803.587 682.449
## ROA                         0.223   1.112
```

```
# summary statistics for all the variables

summData <- as.matrix(data[,6:dim(data)[2]]) # just numeric variables
summaryResults <- list()

allMin <- apply(summData, MARGIN = 2, FUN = min, na.rm=TRUE)
allMean <- apply(summData, MARGIN = 2, FUN = mean, na.rm=TRUE)
allMax <- apply(summData, MARGIN = 2, FUN = max, na.rm=TRUE)
allSD <- apply(summData, MARGIN = 2, FUN = sd, na.rm=TRUE)
allCorr <- round(cor(summData[,-c(1:4)]),digits = 4) # maybe a heatmap
summaryResults$All <- round(data.frame(allMin,allMean,allMax,allSD), digits = 3)
```

Need to calculate panel wise summary (country and year wise)

correlation heatmap

Book of envelop calc and their figures

```r
# Asset and total equity (i)

dataFig <- data
dataFig$year <- as.numeric(dataFig$year)

dataFig %>%
  group_by(year) %>%
  summarise(
    `Median`=median(TA_TE),
    `25th Percentile` = quantile(TA_TE, probs = 0.25),
    `75th Percentile` = quantile(TA_TE, probs = 0.75)
  ) %>%
  ungroup() %>%
  pivot_longer(cols = -year,names_to = "variable",values_to = "value") %>%
  ggplot(mapping = aes(x=year, y=value, col=variable))+
  geom_line()+
  ylim(c(8,30))+
  theme_bw()+
  xlab('')+
  ylab('')
```
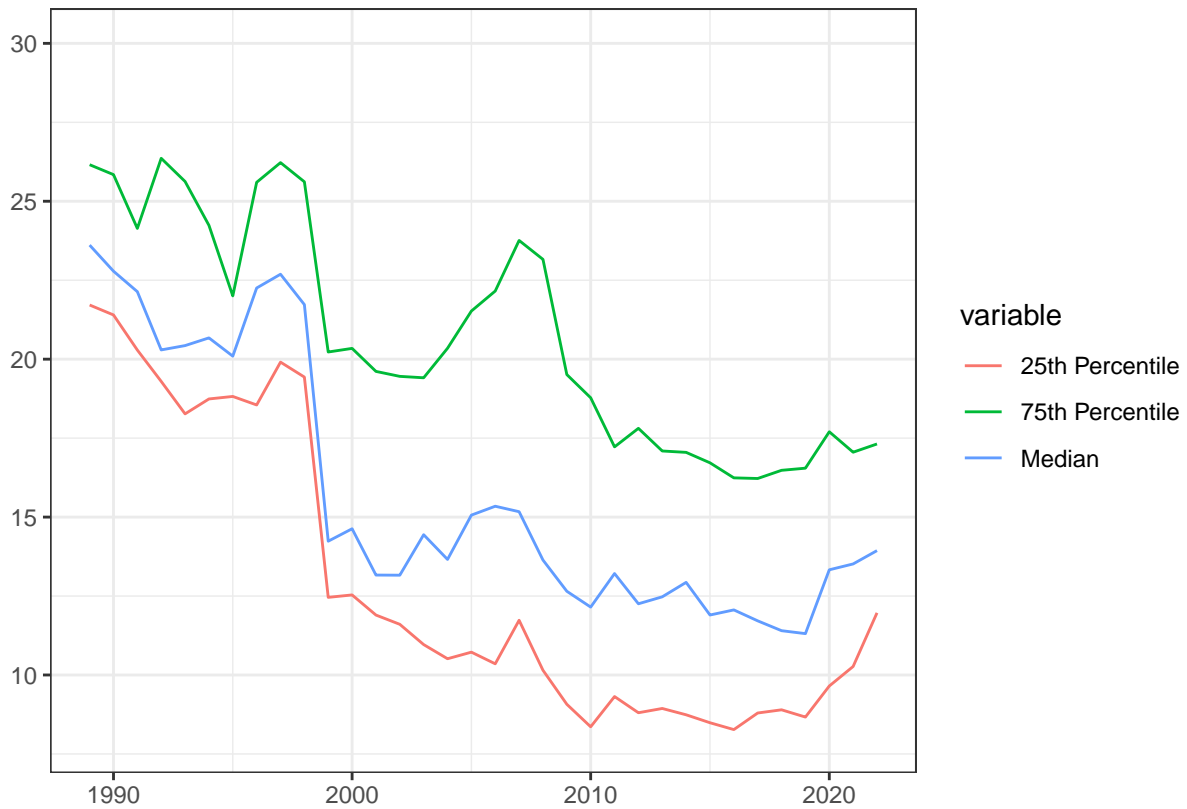
```
# RWA and TierCap (i)

dataFig %>%
  group_by(year) %>%
  summarise(
    `Median`=median(RWA_TierCap),
    `25th Percentile` = quantile(RWA_TierCap, probs = 0.25),
    `75th Percentile` = quantile(RWA_TierCap, probs = 0.75)
  ) %>%
  ungroup() %>%
  pivot_longer(cols = -year,names_to = "variable",values_to = "value") %>%
  ggplot(mapping = aes(x=year, y=value, col=variable))+
  geom_line()+
  theme_bw()+
  xlab('')+
  ylab('')
```
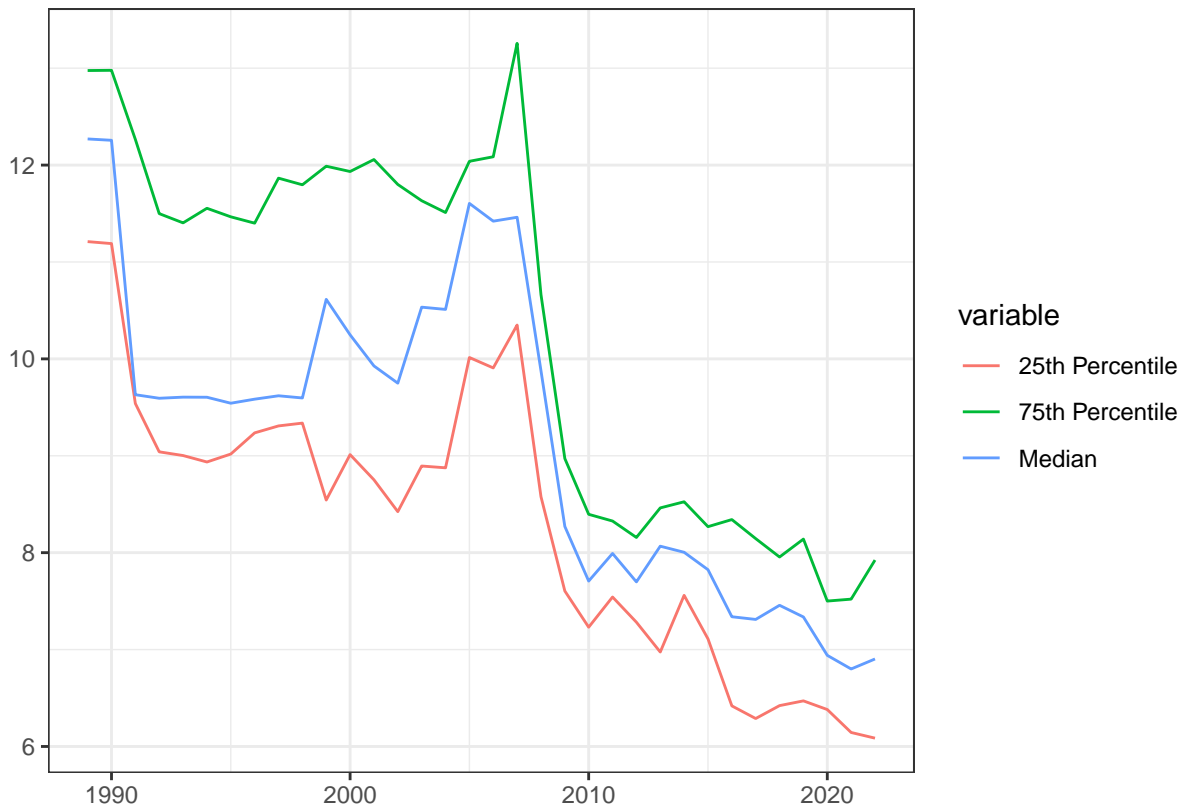
```
# Total fair value of the asset and the market value of the equity (need the market value of equity) (i

dataFig %>%
  group_by(year) %>%
  summarise(
    `Median`=median(FVA_TCE),
    `25th Percentile` = quantile(FVA_TCE, probs = 0.25),
    `75th Percentile` = quantile(FVA_TCE, probs = 0.75)
  ) %>%
  ungroup() %>%
  pivot_longer(cols = -year,names_to = "variable",values_to = "value") %>%
  ggplot(mapping = aes(x=year, y=value, col=variable))+
  geom_line()+
  theme_bw()+
  xlab('')+
  ylab('')
```
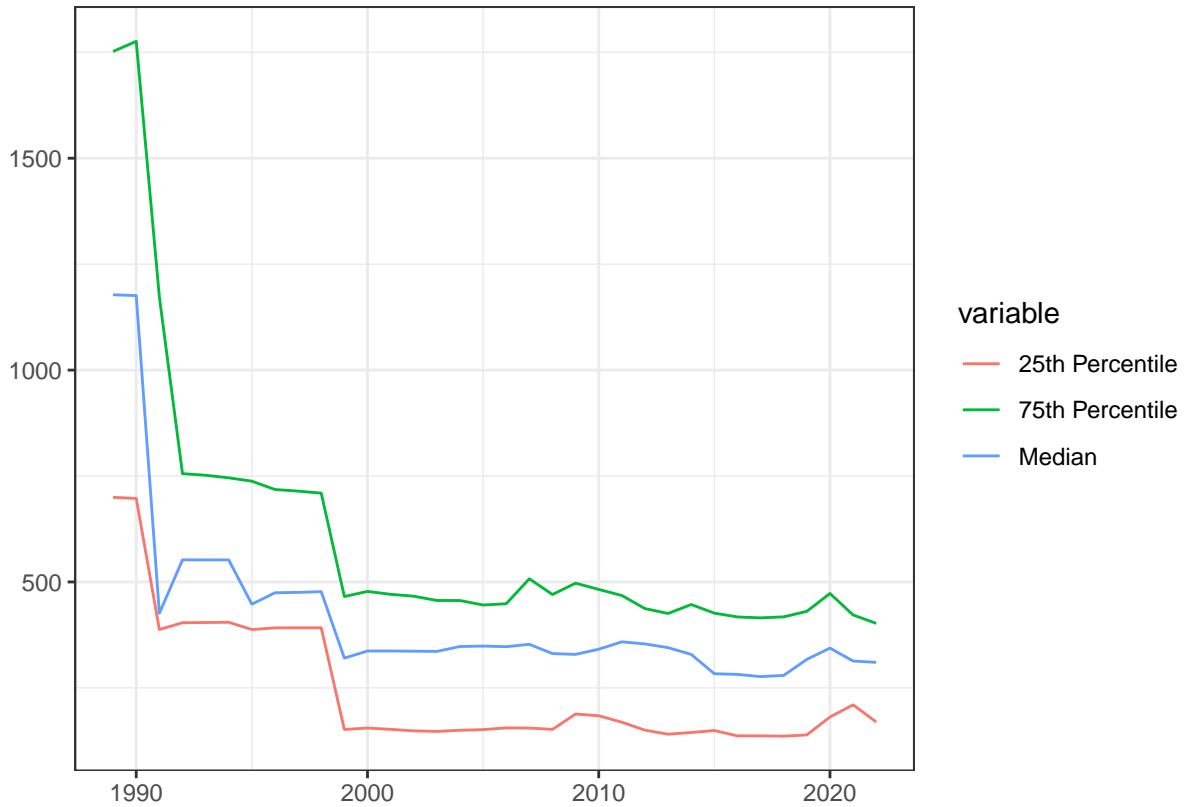
Regression analysis

Proposition 1: Elasticity of bank activity with respect to bank capital

```
# model results

q1modeli <- plm(formula = log(TA)~log(TCE),model = 'within',data = data)
q1modelii <- plm(formula = log(TA)~log(TCE)+ROA,model = 'within',data = data)
q1modeliii <- plm(formula = log(TA)~log(TCE)+ROA,model = 'within',index = c('bankID'), data = data)
q1modeliv <- plm(formula = log(TA)~log(TCE)+ROA,model = 'within',index = c('bankID','year'),data = data)
q1modelv <- plm(formula = log(TA)~log(TCE)+ROA,model = 'within',effect = 'twoways',index = c('bankID','y


# compiling the results
result1 <- stargazer(q1modeli,q1modelii,q1modeliii,q1modeliv,q1modelv, type = 'text',
        omit.summary.stat = 'mean',header = FALSE,
        digits = 3)
```

```
##
## ============================================================================================
##                                         Dependent variable:
##              ------------------------------------------------------------------------------
##                                               log(TA)
```

```
##                           (1)                       (2)                       (3)
## ----------------------------------------------------------------------------------------------------
## log(TCE)                 1.050***                  1.024***                  0.868***
##                          (0.018)                   (0.015)                   (0.009)
##
## ROA                                                -0.421***                 -0.088***
##                                                    (0.025)                   (0.015)
##
## ----------------------------------------------------------------------------------------------------
## Observations               709                       709                       709
## R2                        0.831                     0.881                     0.936
## Adjusted R2               0.823                     0.875                     0.933
## F Statistic  3,318.591*** (df = 1; 674) 2,490.432*** (df = 2; 673) 4,957.591*** (df = 2; 681) 4,957.5
## ====================================================================================================
## Note:
```

result1

```
##  [1] ""
##  [2] "===================================================================================================
##  [3] "                                                                  Dependent variable:
##  [4] "                  -------------------------------------------------------------------------------
##  [5] "                                                                      log(TA)
##  [6] "                            (1)                       (2)                       (3)
##  [7] "-------------------------------------------------------------------------------------------------
##  [8] "log(TCE)                 1.050***                  1.024***                  0.868***
##  [9] "                         (0.018)                   (0.015)                   (0.009)
## [10] "
## [11] "ROA                                                -0.421***                 -0.088***
## [12] "                                                   (0.025)                   (0.015)
## [13] "
## [14] "-------------------------------------------------------------------------------------------------
## [15] "Observations              709                       709                       709
## [16] "R2                       0.831                     0.881                     0.936
## [17] "Adjusted R2              0.823                     0.875                     0.933
## [18] "F Statistic  3,318.591*** (df = 1; 674) 2,490.432*** (df = 2; 673) 4,957.591*** (df = 2; 681) 4
## [19] "===================================================================================================
## [20] "Note:
```

```
# coeftest
lmtest::coeftest(q1modeli,vcovHC(q1modeli,type = 'HC0',cluster = 'group'))
```

```
##
## t test of coefficients:
##
##          Estimate Std. Error t value  Pr(>|t|)
## log(TCE) 1.049714   0.006856  153.11 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# serial correlation method
pbgtest(q1modeli,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  log(TA) ~ log(TCE)
## chisq = 150.23, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q1modelii,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  log(TA) ~ log(TCE) + ROA
## chisq = 97.914, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q1modeliii,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  log(TA) ~ log(TCE) + ROA
## chisq = 405.07, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q1modeliv,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  log(TA) ~ log(TCE) + ROA
## chisq = 405.07, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q1modelv,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  log(TA) ~ log(TCE) + ROA
## chisq = 418.59, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

Proposition 2: How does equity react to changes in the business and financial cycle?

- growth rate of common equity == gdp growth+lag(common equity growth)+ROA+IFRS, index=('bankID') ——(i)

- growth rate of common equity == stock market growth + lag(common equity growth)+ROA+IFRS, index=('bankID')——(ii)

- growth rate of common equity == gdp growth:crisis_II+lag(common equity growth)+ROA+IFRS, index=('bankID') ——(iii)

- growth rate of common equity == stock market growth:crisis_II+lag(common equity growth)+ROA+IFRS, index=('bankID') ——(iv)

- growth rate of Tier 1 capital == gdp growth+lag(growth rate of Tier 1 capita)+ROA+IFRS, index=('bankID') ——(i)

- growth rate of Tier 1 capital == stock market growth +lag(growth rate of Tier 1 capita)+ROA+IFRS, index=('bankID') ——(ii)

- growth rate of Tier 1 capital == gdp growth:crisis_II + lag(growth rate of Tier 1 capita)+ROA+IFRS, index=('bankID')——(iii)

- growth rate of Tier 1 capital == stock market growth:crisis_II +lag(growth rate of Tier 1 capita)+ROA+IFRS, index=('bankID') ——(iv)

```r
# models

q2_1modeli <- plm(formula = TCEG~lag(TCEG)+GDPGrowth+ROA+IFRS,
                 index = 'bankID',model = 'within',data = data)

q2_1modelii <- plm(formula = TCEG~lag(TCEG)+SMGSnP500+ROA+IFRS,
                 index = 'bankID',model = 'within',data = data)

q2_1modeliii <- plm(formula = TCEG~lag(TCEG)+GDPGrowth:crisisGfc+ROA+IFRS,
                  index = 'bankID',model = 'within',data = data)

q2_1modeliv <- plm(formula = TCEG~lag(TCEG)+SMGSnP500:crisisGfc+ROA+IFRS,
                  index = 'bankID',model = 'within',data = data)

# results

stargazer(q2_1modeli,q2_1modelii,q2_1modeliii,q2_1modeliv, type = 'text',
        omit.summary.stat = 'mean',
        digits=3)
```

```
## 
## =====================================================================
##                                  Dependent variable:
##                       -------------------------------------
##                                        TCEG
##                         (1)       (2)        (3)       (4)
## -------------------------------------------------------------------
## lag(TCEG)             -0.075**  -0.078**   -0.071*   -0.077**
##                       (0.037)   (0.038)    (0.040)   (0.039)
## 
## GDPGrowth             -1.045***
##                       (0.335)
## 
## SMGSnP500                       -0.080*
##                                 (0.044)
## 
## ROA                   11.498*** 10.466*** 9.980***  10.138***
```

```
##                                 (1.345)   (1.289)   (1.262)   (1.293)
##
## GDPGrowth:crisisGfc                                  -0.559
##                                                      (0.626)
##
## SMGSnP500:crisisGfc                                            -0.045
##                                                                (0.076)
##
## ----------------------------------------------------------------
## Observations                      683       683       683       683
## R2                               0.101     0.093     0.089     0.089
## Adjusted R2                      0.063     0.054     0.050     0.050
## F Statistic (df = 3; 654) 24.609*** 22.251*** 21.340*** 21.175***
## ================================================================
## Note:                             *p<0.1; **p<0.05; ***p<0.01
```

```r
# serial correlatio test

pbgtest(q2_1modeli,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TCEG ~ lag(TCEG) + GDPGrowth + ROA + IFRS
## chisq = 0.55413, df = 1, p-value = 0.4566
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```r
pbgtest(q2_1modelii,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TCEG ~ lag(TCEG) + SMGSnP500 + ROA + IFRS
## chisq = 0.54183, df = 1, p-value = 0.4617
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```r
pbgtest(q2_1modeliii,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TCEG ~ lag(TCEG) + GDPGrowth:crisisGfc + ROA + IFRS
## chisq = 0.0090727, df = 1, p-value = 0.9241
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```r
pbgtest(q2_1modeliv,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TCEG ~ lag(TCEG) + SMGSnP500:crisisGfc + ROA + IFRS
## chisq = 0.0047951, df = 1, p-value = 0.9448
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```r
# 2nd part ---------------------------------------------------------------------


# Models


q2_2modeli <- plm(formula = TierCapGrowth~lag(TierCapGrowth)+GDPGrowth+ROA+IFRS,
                  index = 'bankID',model = 'within',data = data)

q2_2modelii <- plm(formula = TierCapGrowth~lag(TierCapGrowth)+SMGSnP500+ROA+IFRS,
                   index = 'bankID',model = 'within',data = data)

q2_2modeliii <- plm(formula = TierCapGrowth~lag(TierCapGrowth)+GDPGrowth:crisisGfc+ROA+IFRS,
                    index = 'bankID',model = 'within',data = data)

q2_2modeliv <- plm(formula = TierCapGrowth~lag(TierCapGrowth)+SMGSnP500:crisisGfc+ROA+IFRS,
                   index = 'bankID',model = 'within',data = data)


# results

stargazer(q2_2modeli,q2_2modelii,q2_2modeliii,q2_2modeliv, type = 'text',
          omit.summary.stat = 'mean',
          digits = 3)
```

```
## 
## ===================================================================
##                                 Dependent variable:
##                     -----------------------------------------------
##                                     TierCapGrowth
##                         (1)       (2)       (3)       (4)
## -------------------------------------------------------------------
## lag(TierCapGrowth)   -0.214*** -0.204*** -0.200*** -0.202***
##                       (0.037)   (0.038)   (0.038)   (0.037)
## 
## GDPGrowth            -1.736***
##                       (0.361)
## 
## SMGSnP500                       -0.116**
##                                 (0.048)
## 
## ROA                   3.265**    1.445     0.647     1.542
##                       (1.436)   (1.386)   (1.361)   (1.394)
## 
## GDPGrowth:crisisGfc                         0.596
##                                            (0.647)
## 
## SMGSnP500:crisisGfc                                 -0.196**
##                                                     (0.080)
## 
## -------------------------------------------------------------------
## Observations            683       683       683       683
## R2                     0.075     0.051     0.043     0.051
```

```
## Adjusted R2                     0.035      0.010      0.003      0.010
## F Statistic (df = 3; 654) 17.681*** 11.648*** 9.913***   11.680***
## ================================================================
## Note:                                  *p<0.1; **p<0.05; ***p<0.01
```

```
# serial correlation test

pbgtest(q2_2modeli,order = 1)
```

```
##
##   Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TierCapGrowth ~ lag(TierCapGrowth) + GDPGrowth + ROA + IFRS
## chisq = 14.192, df = 1, p-value = 0.0001651
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q2_2modelii,order = 1)
```

```
##
##   Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TierCapGrowth ~ lag(TierCapGrowth) + SMGSnP500 + ROA + IFRS
## chisq = 5.0469, df = 1, p-value = 0.02467
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q2_2modeliii,order = 1)
```

```
##
##   Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TierCapGrowth ~ lag(TierCapGrowth) + GDPGrowth:crisisGfc + ROA +  ...
## chisq = 2.2472, df = 1, p-value = 0.1339
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q2_2modeliv,order = 1)
```

```
##
##   Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TierCapGrowth ~ lag(TierCapGrowth) + SMGSnP500:crisisGfc + ROA +  ...
## chisq = 4.0768, df = 1, p-value = 0.04348
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
# Hensen Test is required (to be done)
```

Proposition 3: Impact of bank capitalisation on funding costs

```r
# without macroVar ---------------------------------------------------------------

q3_1modeli <- plm(formula = FundingCost~lag(FundingCost)+lag(TA_TE)
                  +ROA +factor(IFRS),
                  index = c('bankID','year'),
                  model = 'fd',
                  data = data)

q3_1modelii <- plm(formula = FundingCost~lag(FundingCost)+lag(RWA_TierCap)
                   +ROA+factor(IFRS),
                   index = c('bankID','year'),
                   model = 'fd',data = data)

# 2nd part (with macro variables) ----------------------------------------------


q3_2modeli <- plm(formula = FundingCost~lag(FundingCost)+lag(TA_TE)
                  +GDPGrowth+SMGSnP500
                  +ROA +factor(IFRS),
                  index = c('bankID','year'),
                  model = 'fd',
                  data = data)

q3_2modelii <- plm(formula = FundingCost~lag(FundingCost)+lag(RWA_TierCap)
                   +GDPGrowth+SMGSnP500
                   +ROA+factor(IFRS),
                   index = c('bankID','year'),
                   model = 'fd',data = data)

q3_2modeliii <- plm(formula = FundingCost~lag(FundingCost)+lag((TCE/TA)*100)
                    +GDPGrowth+SMGSnP500
                    +ROA+factor(IFRS),
                    index = c('bankID','year'),
                    model = 'fd',data = data)


stargazer(q3_1modeli, q3_1modelii, q3_2modeli, q3_2modelii, q3_2modeliii,
          type = 'text',
          omit.summary.stat = 'mean',
          digits = 3)
```

```
## 
## ===========================================================================
##                                    Dependent variable:
##                  ----------------------------------------------------------
##                                        FundingCost
##                        (1)             (2)             (3)             (4)
## ---------------------------------------------------------------------------
## lag(FundingCost)     -0.076**        -0.069*         -0.074*         -0.070*
##                      (0.039)         (0.039)         (0.039)         (0.039)
## 
## lag(TA_TE)           -0.005                          -0.013
##                      (0.018)                         (0.018)
```

```
## 
## lag(RWA_TierCap)                                  0.057                                    0.041
##                                                   (0.040)                                  (0.040)
## 
## lag((TCE/TA) * 100)
## 
## 
## GDPGrowth                                                              0.013                 0.013
##                                                                       (0.026)               (0.026)
## 
## SMGSnP500                                                           -0.012***             -0.011**
##                                                                       (0.004)               (0.004)
## 
## ROA                          0.140            0.151                  0.238**               0.238**
##                             (0.108)          (0.108)                 (0.114)               (0.114)
## 
## Constant                    -0.062           -0.053                 -0.067                -0.059
##                             (0.053)          (0.053)                 (0.052)               (0.053)
## 
## ------------------------------------------------------------------------------------------------
## Observations                  655              655                    655                   655
## R2                           0.009            0.012                  0.024                 0.025
## Adjusted R2                  0.005            0.008                  0.017                 0.017
## F Statistic          2.037 (df = 3; 651) 2.692** (df = 3; 651) 3.217*** (df = 5; 649) 3.320*** (df = 5
## ================================================================================================
## Note:
```

```r
pbgtest(q3_1modeli,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  FundingCost ~ lag(FundingCost) + lag(TA_TE) + ROA + factor(IFRS)
## chisq = 79.673, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```r
pbgtest(q3_1modelii,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  FundingCost ~ lag(FundingCost) + lag(RWA_TierCap) + ROA + factor(IFRS)
## chisq = 77.519, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```r
pbgtest(q3_2modeli,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  FundingCost ~ lag(FundingCost) + lag(TA_TE) + GDPGrowth + SMGSnP500 +  ...
## chisq = 71.897, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q3_2modelii,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  FundingCost ~ lag(FundingCost) + lag(RWA_TierCap) + GDPGrowth +  ...
## chisq = 71.357, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q3_2modeliii,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  FundingCost ~ lag(FundingCost) + lag((TCE/TA) * 100) + GDPGrowth +  ...
## chisq = 67.99, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

Proposition 4: Do less leveraged banks get more funding?

```
# without macroVar --------------------------------------------------------------

q4_1modeli <- plm(formula = TFundGrow~lag(TFundGrow)+lag(TA_TE)+ROA+factor(IFRS),
                  index = c('bankID','year'),
                  model = 'within',
                  data = data)
q4_1modelii <- plm(formula = TFundGrow~lag(TFundGrow)+lag(RWA_TierCap)+ROA+factor(IFRS),
                   index = c('bankID','year'),
                   model = 'within',
                   data = data)

# 2nd part (with macro variables) ----------------------------------------------


q4_2modeli <- plm(formula = TFundGrow~lag(TFundGrow)+lag(TA_TE)
                  +GDPGrowth+SMGSnP500+ROA+factor(IFRS),
                  index = c('bankID','year'),
                  model = 'within',
                  data = data)

q4_2modelii <- plm(formula = TFundGrow~lag(TFundGrow)+lag(RWA_TierCap)
                   +GDPGrowth+SMGSnP500+ROA+factor(IFRS),
                   index = c('bankID','year'),
                   model = 'fd',data = data)

stargazer(q4_1modeli, q4_1modelii, q4_2modeli, q4_2modelii,
          type = 'text',
          omit.summary.stat = 'mean',
          digits = 3)
```

```
## 
## =================================================================================================
##                                          Dependent variable:
##                    -----------------------------------------------------------------------------
##                                               TFundGrow
##                          (1)                (2)                (3)                (4)
## -------------------------------------------------------------------------------------------------
## lag(TFundGrow)         0.084**            0.043             0.093**           -0.395*
##                        (0.039)            (0.039)            (0.039)            (0.035
## 
## lag(TA_TE)             0.031                                 0.010
##                        (0.146)                               (0.149)
## 
## lag(RWA_TierCap)                          1.560***                              0.743
##                                           (0.293)                               (0.567
## 
## GDPGrowth                                                   -1.180***          -1.497*
##                                                             (0.429)            (0.370
## 
## SMGSnP500                                                    0.030             0.196**
##                                                             (0.058)            (0.063
## 
## ROA                    5.545***           4.935***           7.096***           2.400
##                        (1.300)            (1.278)            (1.393)            (1.609
## 
## Constant                                                                      -0.51
##                                                                                (0.743
## 
## -------------------------------------------------------------------------------------------------
## Observations           681                681                681                655
## R2                     0.036              0.076              0.049              0.194
## Adjusted R2           -0.006              0.036              0.005              0.188
## F Statistic     8.023*** (df = 3; 652) 17.833*** (df = 3; 652) 6.716*** (df = 5; 650) 31.232*** (df
## =================================================================================================
## Note:                                                                    *p<0.1; **p<0.05;
```

```
pbgtest(q4_1modeli,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  TFundGrow ~ lag(TFundGrow) + lag(TA_TE) + ROA + factor(IFRS)
## chisq = 1.3239, df = 1, p-value = 0.2499
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q4_1modelii,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  TFundGrow ~ lag(TFundGrow) + lag(RWA_TierCap) + ROA + factor(IFRS)
## chisq = 1.4715, df = 1, p-value = 0.2251
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q4_2modeli,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TFundGrow ~ lag(TFundGrow) + lag(TA_TE) + GDPGrowth + SMGSnP500 +  ...
## chisq = 1.0095, df = 1, p-value = 0.315
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q4_2modelii,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  TFundGrow ~ lag(TFundGrow) + lag(RWA_TierCap) + GDPGrowth + SMGSnP500 +  ...
## chisq = 90.914, df = 1, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

Proposition 5: Do less leveraged banks supply more credit?

```
# without macroVar -------------------------------------------------------------

q5_1modeli <- plm(formula = LG~lag(LG)+lag(TA_TE)+ROA+factor(IFRS),
                  index = c('bankID','year'),
                  model = 'within',
                  data = data)
q5_1modelii <- plm(formula = LG~lag(LG)+lag(RWA_TierCap)+ROA+factor(IFRS),
                   index = c('bankID','year'),
                   model = 'within',
                   data = data)

# 2nd part (with macro variables) ----------------------------------------------


q5_2modeli <- plm(formula = LG~lag(LG)+lag(TA_TE)+ROA+factor(IFRS)
                  +GDPGrowth+SMGSnP500,
                  index = c('bankID','year'),
                  model = 'within',
                  data = data)

q5_2modelii <- plm(formula = LG~lag(LG)+lag(RWA_TierCap)+ROA+factor(IFRS)
                   +GDPGrowth+SMGSnP500,
                   index = c('bankID','year'),
                   model = 'fd',data = data)

stargazer(q5_1modeli, q5_1modelii, q5_2modeli, q5_2modelii,
          type = 'text',
          omit.summary.stat = 'mean',
          digits = 3)
```

```
## 
## =====================================================================================
##                                             Dependent variable:                       
##                    -----------------------------------------------------------------
##                                                     LG                                
##                          (1)              (2)              (3)              (4)
## -------------------------------------------------------------------------------------
## lag(LG)                 0.029            0.020            0.031           -0.456*
##                        (0.036)          (0.037)          (0.036)          (0.034
## 
## lag(TA_TE)             0.545***                          0.524***
##                        (0.156)                          (0.160)
## 
## lag(RWA_TierCap)                         0.968***                          0.04(
##                                         (0.324)                          (0.62!
## 
## ROA                    5.604***         5.259***         4.943***         -1.174
##                        (1.404)          (1.412)          (1.517)          (1.74!
## 
## GDPGrowth                                                 0.693            0.37(
##                                                          (0.463)          (0.40-
## 
## SMGSnP500                                                -0.058           -0.01!
##                                                          (0.062)          (0.06!
## 
## Constant                                                                  -0.32!
##                                                                          (0.81(
## 
## -------------------------------------------------------------------------------------
## Observations            681              681              681              655
## R2                     0.044            0.040            0.048            0.23(
## Adjusted R2            0.003           -0.001            0.004            0.22
## F Statistic    10.121*** (df = 3; 652) 9.021*** (df = 3; 652) 6.524*** (df = 5; 650) 38.720*** (df
## =====================================================================================
## Note:                                                              *p<0.1; **p<0.05;
```

```
pbgtest(q5_1modeli,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  LG ~ lag(LG) + lag(TA_TE) + ROA + factor(IFRS)
## chisq = 3.8547, df = 1, p-value = 0.04961
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q5_1modelii,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  LG ~ lag(LG) + lag(RWA_TierCap) + ROA + factor(IFRS)
## chisq = 4.6812, df = 1, p-value = 0.03049
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q5_2modeli,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  LG ~ lag(LG) + lag(TA_TE) + ROA + factor(IFRS) + GDPGrowth +  ...
## chisq = 3.5309, df = 1, p-value = 0.06023
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q5_2modelii,order = 1)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  LG ~ lag(LG) + lag(RWA_TierCap) + ROA + factor(IFRS) + GDPGrowth +  ...
## chisq = 60.863, df = 1, p-value = 6.119e-15
## alternative hypothesis: serial correlation in idiosyncratic errors
```

Proposition: 07: The effect of bank capital in the monetary transmission mechanism

```
# without macroVar ------------------------------------------------------------

q6_1modeli <- plm(formula = LG~lag(LG)+lag(TA_TE)+(lag(TA_TE)*MPGrowth),
                  index = c('bankID','year'),
                  model = 'within',
                  data = data)
q6_1modelii <- plm(formula = LG~lag(LG)+lag(RWA_TierCap)+(lag(RWA_TierCap)*MPGrowth),
                   index = c('bankID','year'),
                   model = 'within',
                   data = data)

# 2nd part (with macro variables) -----------------------------------------------


q6_2modeli <- plm(formula = LG~lag(LG)+lag(TA_TE)+(lag(TA_TE)*MPGrowth)+
                    ROA+factor(IFRS)+
                    GDPGrowth+SMGSnP500,
                  index = c('bankID','year'),
                  model = 'within',
                  data = data)

q6_2modelii <- plm(formula = LG~lag(LG)+lag(RWA_TierCap)+(lag(RWA_TierCap)*MPGrowth)+
                     ROA+factor(IFRS)
                    +GDPGrowth+SMGSnP500,
                   index = c('bankID','year'),
                   model = 'within',data = data)

stargazer(q6_1modeli, q6_1modelii, q6_2modeli, q6_2modelii,
          type = 'text',
          omit.summary.stat = 'mean',
          digits = 3)
```

```
## 
## =================================================================================================
##                                               Dependent variable:
##                     ------------------------------------------------------------------------------
##                                                       LG
##                            (1)                  (2)                  (3)
## -------------------------------------------------------------------------------------------------
## lag(LG)                   0.038                0.028                0.033
##                          (0.036)              (0.037)              (0.036)
## 
## lag(TA_TE)               0.473***                                 0.425**
##                          (0.177)                                  (0.180)
## 
## lag(RWA_TierCap)                               1.147***
##                                               (0.327)
## 
## MPGrowth                 0.044**              -0.015               0.042**
##                          (0.020)              (0.035)              (0.020)
## 
## ROA                                                               4.770***
##                                                                   (1.517)
## 
## GDPGrowth                                                          0.617
##                                                                   (0.483)
## 
## SMGSnP500                                                         -0.040
##                                                                   (0.064)
## 
## lag(TA_TE):MPGrowth      -0.002                                   -0.002*
##                          (0.001)                                  (0.001)
## 
## lag(RWA_TierCap):MPGrowth                      0.004
##                                               (0.005)
## 
## -------------------------------------------------------------------------------------------------
## Observations               681                  681                  681
## R2                        0.031                0.026                0.054
## Adjusted R2              -0.012               -0.017                0.008
## F Statistic       5.175*** (df = 4; 651) 4.341*** (df = 4; 651) 5.326*** (df = 7; 648) 4.303=
## =================================================================================================
## Note:                                                                        *p<0.1; **p
```

```
pbgtest(q6_1modeli,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  LG ~ lag(LG) + lag(TA_TE) + (lag(TA_TE) * MPGrowth)
## chisq = 0.46336, df = 1, p-value = 0.4961
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q6_1modelii,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  LG ~ lag(LG) + lag(RWA_TierCap) + (lag(RWA_TierCap) * MPGrowth)
## chisq = 0.82127, df = 1, p-value = 0.3648
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q6_2modeli,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  LG ~ lag(LG) + lag(TA_TE) + (lag(TA_TE) * MPGrowth) + ROA + factor(IFRS) +  ...
## chisq = 3.9194, df = 1, p-value = 0.04773
## alternative hypothesis: serial correlation in idiosyncratic errors
```

```
pbgtest(q6_2modelii,order = 1)
```

```
## 
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
## 
## data:  LG ~ lag(LG) + lag(RWA_TierCap) + (lag(RWA_TierCap) * MPGrowth) +  ...
## chisq = 3.9799, df = 1, p-value = 0.04605
## alternative hypothesis: serial correlation in idiosyncratic errors
```