```
#Prep#


rm(list=ls())



library("rmarkdown")
library("tinytex")
library("readxl")
library("zoo")
library("ExcelFunctionsR")
library("runner")
library("car")
library("magrittr")
library("tidyverse")
library("DescTools")
library("dplyr")
library("formatR")
library("censReg")
library("survival")
library("VGAM")
library("lmtest")
library("sandwich")
library("Metrics")
library("stargazer")


data_compustat <-
  read_excel(
    "C:/Users/marki/OneDrive/Skole/Master Thesis/After Preliminary/Portfolio/Covid-19 dividends/Optimal_Cash/Data 22.04.2023_Final.xlsx",
                                    sheet = "Data_Compustat")
```

```
data_compustat <- as.data.frame(data_compustat)



data_compustat$fiscal_date <-
  as.Date(paste0(data_compustat$`Data Year - Fiscal`, "-01-01"),
                                format = "%Y-%m-%d")

data_compustat <- data_compustat %>% mutate(year = year(fiscal_date))
data_compustat$`2-Digit SIC` <- LEFT(data_compustat$`Standard Industry Classification Code`, 2)
data_compustat$`1-Digit SIC` <- LEFT(data_compustat$`Standard Industry Classification Code`, 1)
data_compustat <- data_compustat %>% mutate(industry = as.factor(`2-Digit SIC`))



##Creating variables for Optimal Cash Regression##



data_compustat$industry_CF <- (data_compustat$`Operating Income Before Depreciation`-
  data_compustat$`Interest and Related Expense - Total`- data_compustat$`Income Taxes - Total` -
  data_compustat$`Dividends Common/Ordinary`)/(data_compustat$`Assets - Total`-
                                        data_compustat$`Cash and Short-Term Investments`)

data <- data_compustat %>%
  arrange(`2-Digit SIC`, year) %>%
  group_by(`2-Digit SIC`) %>%
  mutate(industry_sigma = rollapply(industry_CF, width = 20, FUN = sd, fill = NA,
                                align = "right")) %>%
  mutate(industry_sigma = na.locf(industry_sigma, na.rm = FALSE))
```

```
data$year_Dummy <- factor(data$`Data Year - Fiscal`)

data$IPO_Date <- as.Date(data$IPO_Date, origin = "1899-12-30")

data$assets_less_cash <- data$`Assets - Total`-data$`Cash and Short-Term Investments`

data$cash <- data$`Cash and Short-Term Investments`/data$assets_less_cash



data$firm_size <- log(data$`Assets - Total`)

data$working_capital <- (data$`Working Capital (Balance Sheet)` -
                         data$`Cash and Short-Term Investments`)/data$assets_less_cash



data$capex <- data$Acquisitions / data$assets_less_cash

data <- data %>% group_by(`Ticker Symbol`) %>%
  mutate(lag_capex = lag(capex[`Ticker Symbol`==`Ticker Symbol` & year==year]))



data$RD <- data$`Research and Development Expense`/
  data$`Assets - Total`

data["RD"][is.na(data["RD"])] <- 0



data <- data %>% group_by(`Ticker Symbol`) %>%
  mutate(sales_growth = (`Sales/Turnover (Net)`-lag(`Sales/Turnover (Net)`[`Ticker Symbol`==`Ticker
Symbol` & year==year]))/
```

```
        lag(`Sales/Turnover (Net)`[`Ticker Symbol`==`Ticker Symbol` & year==year]))



data$CF_from_Operations <- data$`Operating Activities - Net Cash Flow`/
                           data$assets_less_cash



data <- data %>% mutate(firm_age = year - year(IPO_Date))

data$log_age <- log(data$firm_age)

data$US_corp_tax_t <- ifelse(data$year < 2018, 0.35, 0.21)

data$Foreign_Tax <- (data$`Pretax Income - Foreign` *data$US_corp_tax_t -
  data$`Income Taxes - Foreign`)/data$assets_less_cash

data["Foreign_Tax"][is.na(data["Foreign_Tax"])] <- 0

data$dividend_dummy <- ifelse(data$`Dividends Common/Ordinary`>0, 1, 0)

data["dividend_dummy"][is.na(data["dividend_dummy"])] <- 0



data$dividends_over_Assets_lessCash <- data$`Dividends Common/Ordinary`/
  (data$`Assets - Total`- data$`Cash and Short-Term Investments`)

data[sapply(data, is.infinite)] <- NA

##Winsorize data to 1% and 99% to remove outliers##
```

```
data <- data %>% group_by(year) %>%
  mutate(cash_win = Winsorize(cash, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(capex_win = Winsorize(capex, probs = c(0.05,0.95), na.rm = TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(CF_from_Operations_win = Winsorize(CF_from_Operations, probs = c(0.01,0.99), na.rm =
TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(Foreign_Tax_win = Winsorize(Foreign_Tax, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(RD_win = Winsorize(RD, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(sales_growth_win = Winsorize(sales_growth, probs = c(0.05,0.95), na.rm = TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(working_capital_win = Winsorize(working_capital, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()
```

```
data <- data %>% group_by(year) %>%
  mutate(firm_size_win = Winsorize(firm_size, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(industry_sigma_win = Winsorize(industry_sigma, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data <- data %>% group_by(year) %>%
  mutate(log_age_win = Winsorize(log_age, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()



##Run Optimal Cash Estimate Regression##



Optimal_Cash_reg <- lm(cash ~
                       capex_win +
                       CF_from_Operations_win +
                       Foreign_Tax_win +
                       log_age_win +
                       RD_win +
                       sales_growth_win +
                       working_capital_win+
                       firm_size_win + industry_sigma_win + dividend_dummy +
                       year_Dummy + industry, data = data)



summary(Optimal_Cash_reg)
```

```
bptest(Optimal_Cash_reg)
coeftest(Optimal_Cash_reg, vcov. = vcovHC(Optimal_Cash_reg, type = "HC1"))



##Cash regression on 2006 and up##

optimal_cash_2006 <- lm(cash ~ capex_win +
                          CF_from_Operations_win +
                          Foreign_Tax_win +
                          log_age_win +
                          RD_win +
                          sales_growth_win +
                          working_capital_win+
                          firm_size_win + industry_sigma_win + dividend_dummy +
                          year_Dummy + industry,
                        subset = year > "2005" & year,
                        data = data)



summary(optimal_cash_2006)

coeftest(optimal_cash_2006, vcov. = vcovHC(optimal_cash_2006, type = "HC1"))



#Creating coefficients for estimation of optimal cash#
```

```
cash_intercept <- coef(optimal_cash_2006)[1]
cash_capex <- coef(optimal_cash_2006)[2]
cash_CF_from_operations <- coef(optimal_cash_2006)[3]
cash_foreign_tax <- coef(optimal_cash_2006)[4]
cash_log_age <- coef(optimal_cash_2006)[5]
cash_RD <- coef(optimal_cash_2006)[6]
cash_sales_growth <- coef(optimal_cash_2006)[7]
cash_working_capital <- coef(optimal_cash_2006)[8]
cash_firm_size <- coef(optimal_cash_2006)[9]
cash_industry_sigma <- coef(optimal_cash_2006)[10]
cash_dividend_dummy <- coef(optimal_cash_2006)[11]

cash_2007 <- coef(optimal_cash_2006)[12]
cash_2008 <- coef(optimal_cash_2006)[13]
cash_2009 <- coef(optimal_cash_2006)[14]
cash_2010 <- coef(optimal_cash_2006)[15]
cash_2011 <- coef(optimal_cash_2006)[16]
cash_2012 <- coef(optimal_cash_2006)[17]
cash_2013 <- coef(optimal_cash_2006)[18]
cash_2014 <- coef(optimal_cash_2006)[19]
cash_2015 <- coef(optimal_cash_2006)[20]
cash_2016 <- coef(optimal_cash_2006)[21]
cash_2017 <- coef(optimal_cash_2006)[22]
cash_2018 <- coef(optimal_cash_2006)[23]
cash_2019 <- coef(optimal_cash_2006)[24]
cash_2020 <- coef(optimal_cash_2006)[25]
cash_2021 <- coef(optimal_cash_2006)[26]
cash_2022 <- coef(optimal_cash_2006)[27]

cash_ind_02 <- coef(optimal_cash_2006)[28]
cash_ind_10 <- coef(optimal_cash_2006)[29]
```

```
cash_ind_13 <- coef(optimal_cash_2006)[30]
cash_ind_14 <- coef(optimal_cash_2006)[31]
cash_ind_15 <- coef(optimal_cash_2006)[32]
cash_ind_16 <- coef(optimal_cash_2006)[33]
cash_ind_17 <- coef(optimal_cash_2006)[34]
cash_ind_20 <- coef(optimal_cash_2006)[35]
cash_ind_21 <- coef(optimal_cash_2006)[36]
cash_ind_22 <- coef(optimal_cash_2006)[37]
cash_ind_23 <- coef(optimal_cash_2006)[38]
cash_ind_24 <- coef(optimal_cash_2006)[39]
cash_ind_25 <- coef(optimal_cash_2006)[40]
cash_ind_26 <- coef(optimal_cash_2006)[41]
cash_ind_27 <- coef(optimal_cash_2006)[42]
cash_ind_28 <- coef(optimal_cash_2006)[43]
cash_ind_29 <- coef(optimal_cash_2006)[44]
cash_ind_30 <- coef(optimal_cash_2006)[45]
cash_ind_31 <- coef(optimal_cash_2006)[46]
cash_ind_32 <- coef(optimal_cash_2006)[47]
cash_ind_33 <- coef(optimal_cash_2006)[48]
cash_ind_34 <- coef(optimal_cash_2006)[49]
cash_ind_35 <- coef(optimal_cash_2006)[50]
cash_ind_36 <- coef(optimal_cash_2006)[51]
cash_ind_37 <- coef(optimal_cash_2006)[52]
cash_ind_38 <- coef(optimal_cash_2006)[53]
cash_ind_39 <- coef(optimal_cash_2006)[54]
cash_ind_40 <- coef(optimal_cash_2006)[55]
cash_ind_41 <- coef(optimal_cash_2006)[56]
cash_ind_42 <- coef(optimal_cash_2006)[57]
cash_ind_44 <- coef(optimal_cash_2006)[58]
cash_ind_45 <- coef(optimal_cash_2006)[59]
cash_ind_47 <- coef(optimal_cash_2006)[60]
```

```
cash_ind_48 <- coef(optimal_cash_2006)[61]
cash_ind_49 <- coef(optimal_cash_2006)[62]
cash_ind_50 <- coef(optimal_cash_2006)[63]
cash_ind_51 <- coef(optimal_cash_2006)[64]
cash_ind_52 <- coef(optimal_cash_2006)[65]
cash_ind_53 <- coef(optimal_cash_2006)[66]
cash_ind_54 <- coef(optimal_cash_2006)[67]
cash_ind_55 <- coef(optimal_cash_2006)[68]
cash_ind_56 <- coef(optimal_cash_2006)[69]
cash_ind_57 <- coef(optimal_cash_2006)[70]
cash_ind_58 <- coef(optimal_cash_2006)[71]
cash_ind_59 <- coef(optimal_cash_2006)[72]
cash_ind_65 <- coef(optimal_cash_2006)[73]
cash_ind_72 <- coef(optimal_cash_2006)[74]
cash_ind_73 <- coef(optimal_cash_2006)[75]
cash_ind_75 <- coef(optimal_cash_2006)[76]
cash_ind_78 <- coef(optimal_cash_2006)[77]
cash_ind_79 <- coef(optimal_cash_2006)[78]
cash_ind_80 <- coef(optimal_cash_2006)[79]
cash_ind_82 <- coef(optimal_cash_2006)[80]
cash_ind_87 <- coef(optimal_cash_2006)[81]


data$cash_ind_02 <- ifelse(data$industry == "02", 1, 0)
data$cash_ind_10 <- ifelse(data$industry == "10", 1, 0)
data$cash_ind_13 <- ifelse(data$industry == "13", 1, 0)
data$cash_ind_14 <- ifelse(data$industry == "14", 1, 0)
data$cash_ind_15 <- ifelse(data$industry == "15", 1, 0)
data$cash_ind_16 <- ifelse(data$industry == "16", 1, 0)
data$cash_ind_17 <- ifelse(data$industry == "17", 1, 0)
data$cash_ind_20 <- ifelse(data$industry == "20", 1, 0)
```

```
data$cash_ind_21 <- ifelse(data$industry == "21", 1, 0)
data$cash_ind_22 <- ifelse(data$industry == "22", 1, 0)
data$cash_ind_23 <- ifelse(data$industry == "23", 1, 0)
data$cash_ind_24 <- ifelse(data$industry == "24", 1, 0)
data$cash_ind_25 <- ifelse(data$industry == "25", 1, 0)
data$cash_ind_26 <- ifelse(data$industry == "26", 1, 0)
data$cash_ind_27 <- ifelse(data$industry == "27", 1, 0)
data$cash_ind_28 <- ifelse(data$industry == "28", 1, 0)
data$cash_ind_29 <- ifelse(data$industry == "29", 1, 0)
data$cash_ind_30 <- ifelse(data$industry == "30", 1, 0)
data$cash_ind_31 <- ifelse(data$industry == "31", 1, 0)
data$cash_ind_32 <- ifelse(data$industry == "32", 1, 0)
data$cash_ind_33 <- ifelse(data$industry == "33", 1, 0)
data$cash_ind_34 <- ifelse(data$industry == "34", 1, 0)
data$cash_ind_35 <- ifelse(data$industry == "35", 1, 0)
data$cash_ind_36 <- ifelse(data$industry == "36", 1, 0)
data$cash_ind_37 <- ifelse(data$industry == "37", 1, 0)
data$cash_ind_38 <- ifelse(data$industry == "38", 1, 0)
data$cash_ind_39 <- ifelse(data$industry == "39", 1, 0)
data$cash_ind_40 <- ifelse(data$industry == "40", 1, 0)
data$cash_ind_40 <- ifelse(data$industry == "41", 1, 0)
data$cash_ind_42 <- ifelse(data$industry == "42", 1, 0)
data$cash_ind_44 <- ifelse(data$industry == "44", 1, 0)
data$cash_ind_45 <- ifelse(data$industry == "45", 1, 0)
data$cash_ind_47 <- ifelse(data$industry == "47", 1, 0)
data$cash_ind_48 <- ifelse(data$industry == "48", 1, 0)
data$cash_ind_49 <- ifelse(data$industry == "49", 1, 0)
data$cash_ind_50 <- ifelse(data$industry == "50", 1, 0)
data$cash_ind_51 <- ifelse(data$industry == "51", 1, 0)
data$cash_ind_52 <- ifelse(data$industry == "52", 1, 0)
data$cash_ind_53 <- ifelse(data$industry == "53", 1, 0)
```

```
data$cash_ind_54 <- ifelse(data$industry == "54", 1, 0)
data$cash_ind_55 <- ifelse(data$industry == "55", 1, 0)
data$cash_ind_56 <- ifelse(data$industry == "56", 1, 0)
data$cash_ind_57 <- ifelse(data$industry == "57", 1, 0)
data$cash_ind_58 <- ifelse(data$industry == "58", 1, 0)
data$cash_ind_59 <- ifelse(data$industry == "59", 1, 0)
data$cash_ind_65 <- ifelse(data$industry == "65", 1, 0)
data$cash_ind_72 <- ifelse(data$industry == "72", 1, 0)
data$cash_ind_73 <- ifelse(data$industry == "73", 1, 0)
data$cash_ind_75 <- ifelse(data$industry == "75", 1, 0)
data$cash_ind_78 <- ifelse(data$industry == "78", 1, 0)
data$cash_ind_79 <- ifelse(data$industry == "79", 1, 0)
data$cash_ind_80 <- ifelse(data$industry == "80", 1, 0)
data$cash_ind_82 <- ifelse(data$industry == "82", 1, 0)
data$cash_ind_87 <- ifelse(data$industry == "87", 1, 0)

data$year1988 <- ifelse(data$year == "1988", 1, 0)
data$year1989 <- ifelse(data$year == "1989", 1, 0)
data$year1990 <- ifelse(data$year == "1990", 1, 0)
data$year1991 <- ifelse(data$year == "1991", 1, 0)
data$year1992 <- ifelse(data$year == "1992", 1, 0)
data$year1993 <- ifelse(data$year == "1993", 1, 0)
data$year1994 <- ifelse(data$year == "1994", 1, 0)
data$year1995 <- ifelse(data$year == "1995", 1, 0)
data$year1996 <- ifelse(data$year == "1996", 1, 0)
data$year1997 <- ifelse(data$year == "1997", 1, 0)
data$year1998 <- ifelse(data$year == "1998", 1, 0)
data$year1999 <- ifelse(data$year == "1999", 1, 0)
data$year2000 <- ifelse(data$year == "2000", 1, 0)
data$year2001 <- ifelse(data$year == "2001", 1, 0)
data$year2002 <- ifelse(data$year == "2002", 1, 0)
```

```
data$year2003 <- ifelse(data$year == "2003", 1, 0)
data$year2004 <- ifelse(data$year == "2004", 1, 0)
data$year2005 <- ifelse(data$year == "2005", 1, 0)
data$year2006 <- ifelse(data$year == "2006", 1, 0)
data$year2007 <- ifelse(data$year == "2007", 1, 0)
data$year2008 <- ifelse(data$year == "2008", 1, 0)
data$year2009 <- ifelse(data$year == "2009", 1, 0)
data$year2010 <- ifelse(data$year == "2010", 1, 0)
data$year2011 <- ifelse(data$year == "2011", 1, 0)
data$year2012 <- ifelse(data$year == "2012", 1, 0)
data$year2013 <- ifelse(data$year == "2013", 1, 0)
data$year2014 <- ifelse(data$year == "2014", 1, 0)
data$year2015 <- ifelse(data$year == "2015", 1, 0)
data$year2016 <- ifelse(data$year == "2016", 1, 0)
data$year2017 <- ifelse(data$year == "2017", 1, 0)
data$year2018 <- ifelse(data$year == "2018", 1, 0)
data$year2019 <- ifelse(data$year == "2019", 1, 0)
data$year2020 <- ifelse(data$year == "2020", 1, 0)
data$year2021 <- ifelse(data$year == "2021", 1, 0)
data$year2022 <- ifelse(data$year == "2022", 1, 0)


data$optimal_cash <- (data$industry_sigma*cash_industry_sigma +
  data$firm_size*cash_firm_size + data$working_capital*cash_working_capital +
  data$sales_growth*cash_sales_growth + data$RD*cash_RD +
  data$Foreign_Tax*cash_foreign_tax + data$CF_from_Operations*cash_CF_from_operations +
  data$capex*cash_capex + cash_intercept +
data$dividend_dummy*cash_dividend_dummy+data$cash_ind_02*cash_ind_02
+data$cash_ind_10*cash_ind_10
+data$cash_ind_13*cash_ind_13
+data$cash_ind_14*cash_ind_14
```

+data$cash_ind_15*cash_ind_15

+data$cash_ind_16*cash_ind_16

+data$cash_ind_17*cash_ind_17

+data$cash_ind_20*cash_ind_20

+data$cash_ind_21*cash_ind_21

+data$cash_ind_22*cash_ind_22

+data$cash_ind_23*cash_ind_23

+data$cash_ind_24*cash_ind_24

+data$cash_ind_25*cash_ind_25

+data$cash_ind_26*cash_ind_26

+data$cash_ind_27*cash_ind_27

+data$cash_ind_28*cash_ind_28

+data$cash_ind_29*cash_ind_29

+data$cash_ind_30*cash_ind_30

+data$cash_ind_31*cash_ind_31

+data$cash_ind_32*cash_ind_32

+data$cash_ind_33*cash_ind_33

+data$cash_ind_34*cash_ind_34

+data$cash_ind_35*cash_ind_35

+data$cash_ind_36*cash_ind_36

+data$cash_ind_37*cash_ind_37

+data$cash_ind_38*cash_ind_38

+data$cash_ind_39*cash_ind_39

+data$cash_ind_40*cash_ind_40

+data$cash_ind_42*cash_ind_42

+data$cash_ind_44*cash_ind_44

+data$cash_ind_45*cash_ind_45

+data$cash_ind_47*cash_ind_47

+data$cash_ind_48*cash_ind_48

+data$cash_ind_49*cash_ind_49

+data$cash_ind_50*cash_ind_50

```
+data$cash_ind_51*cash_ind_51
+data$cash_ind_52*cash_ind_52
+data$cash_ind_53*cash_ind_53
+data$cash_ind_54*cash_ind_54
+data$cash_ind_55*cash_ind_55
+data$cash_ind_56*cash_ind_56
+data$cash_ind_57*cash_ind_57
+data$cash_ind_58*cash_ind_58
+data$cash_ind_59*cash_ind_59
+data$cash_ind_65*cash_ind_65
+data$cash_ind_72*cash_ind_72
+data$cash_ind_73*cash_ind_73
+data$cash_ind_75*cash_ind_75
+data$cash_ind_78*cash_ind_78
+data$cash_ind_79*cash_ind_79
+data$cash_ind_80*cash_ind_80
+data$cash_ind_82*cash_ind_82
+data$cash_ind_87*cash_ind_87
+data$year2007*cash_2007
+data$year2008*cash_2008
+data$year2009*cash_2009
+data$year2010*cash_2010
+data$year2011*cash_2011
+data$year2012*cash_2012
+data$year2013*cash_2013
+data$year2014*cash_2014
+data$year2015*cash_2015
+data$year2016*cash_2016
+data$year2017*cash_2017
+data$year2018*cash_2018
+data$year2019*cash_2019
```

```
+data$year2020*cash_2020
+data$year2021*cash_2021
+data$year2022*cash_2022)


data$abnormal_cash <- data$cash - data$optimal_cash

data$excess_cash <- ifelse(data$abnormal_cash>0, data$abnormal_cash, NA)
data$insufficient_cash <- ifelse(data$abnormal_cash<0, data$abnormal_cash, NA)
data$insufficient_cash_abs <- ifelse(data$abnormal_cash<0, data$abnormal_cash*(-1), NA)

data2006 <- data %>% filter(year>"2005")



#Making ESG variables#

data2006$ESG <- log(data2006$`Refinitiv ESG score`)


data2006$log_governance <- log(data2006$`Governance Pillar Score`)

data2006$log_social <- log(data2006$`Social Pillar Score`)

data2006$log_environmental <- log(data2006$`Environmental Pillar score`)

data2006$sh_score <- log(data2006$`shareholders score`)

data2006 %>% distinct(CUSIP) %>% count()
```

##Winsorize ESG variables##

```
data2006 <- data2006 %>% group_by(year) %>%
  mutate(excess_cash_win = Winsorize(excess_cash, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data2006 <- data2006 %>% group_by(year) %>%
  mutate(abnormal_cash_win = Winsorize(abnormal_cash, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data2006 <- data2006 %>% group_by(year) %>%
  mutate(log_governance_win = Winsorize(log_governance, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()
```

##Making variables to test market value of cash##

```
#Exclude financial firms, they have strict cash regulations#
data2 <- data2006 %>% filter(!`1-Digit SIC`=="6")

data2$assets_less_cash_forward <-
  data2$`Assets - Total t+1`-data2$`Cash and Short-Term Investments t+1`

data2$assets_less_cash_lag <-
  data2$`Assets - Total t-1`-data2$`Cash and Short-Term Investments t-1`
```

#Dependent variable. Market value of firm, defined as years closing price times outstaning shares. In millions, scaled by net assets#

```
data2$marketvalue <- (((data2$`Closing price`*data2$`Shares outstanding`)+data2$`Total liabilities`)/(data2$`Assets - Total`-
  data2$`Cash and Short-Term Investments`))/1000000


data2$marketvalue_forward <- (((data2$`Closing price t+1`*data2$`Shares outstanding t+1`)+data2$`Total liabilities t+1`)/
  (data2$`Assets - Total t+1`-data2$`Cash and Short-Term Investments t+1`))/1000000

data2 <- data2 %>% group_by(year) %>%
  mutate(marketvalue_win = Winsorize(marketvalue, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

data2 <- data2 %>% group_by(year) %>%
  mutate(marketvalue_forward_win = Winsorize(marketvalue_forward, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()



##Independent variables##

#EBIT#

data2$ebit <- data2$`Earnings Before Interest and Taxes`/data2$assets_less_cash
data2$ebit_forward <- data2$`Earnings Before Interest and Taxes t+1`/data2$assets_less_cash_forward
data2$ebit_lag <- data2$`Earnings Before Interest and Taxes t-1`/data2$assets_less_cash_lag


data2$ebit_delta_forward <- (data2$ebit_forward-data2$ebit)
data2$ebit_delta <- (data2$ebit-data2$ebit_lag)
```

```
data2 <- data2 %>% group_by(year) %>%
  mutate(ebit_win = Winsorize(ebit, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()


data2 <- data2 %>% group_by(year) %>%
  mutate(ebit_delta_forward_win = Winsorize(ebit_delta_forward, probs = c(0.01,0.99), na.rm =
TRUE)) %>%
  ungroup()

data2 <- data2 %>% group_by(year) %>%
  mutate(ebit_delta_win = Winsorize(ebit_delta, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()


#Net Assets#

data2$net_assets <- data2$`Assets - Total`-data2$`Cash and Short-Term Investments`

data2$net_assets_delta <- (data2$`Assets - Total`-data2$`Assets - Total t-1`)/data2$`Assets - Total t-1`

data2$net_assets_delta_forward <- (data2$assets_less_cash_forward-
data2$assets_less_cash)/data2$assets_less_cash

data2$net_assets_delta[is.infinite(data2$net_assets_delta)] <- 0

data2$net_assets_delta_forward[is.infinite(data2$net_assets_delta_forward)] <- 0

data2 <- data2 %>% group_by(year) %>%
  mutate(net_assets_win = Winsorize(net_assets, probs = c(0.01,0.99), na.rm = TRUE)) %>%
```

```
  ungroup()


data2 <- data2 %>% group_by(year) %>%

  mutate(net_assets_delta_win = Winsorize(net_assets_delta, probs = c(0.01,0.99), na.rm = TRUE))
%>%

  ungroup()


data2 <- data2 %>% group_by(year) %>%

  mutate(net_assets_delta_forward_win = Winsorize(net_assets_delta_forward, probs = c(0.01,0.99),
na.rm = TRUE)) %>%

  ungroup()



#Interest expense#


data2$Int <- data2$`Interest and Related Expense - Total`/data2$assets_less_cash

data2$int_forward <- data2$`Interest and Related Expense - Total
t+1`/data2$assets_less_cash_forward

data2$Int_lag <- data2$`Interest and Related Expense - Total t-1`/data2$assets_less_cash_lag


data2$Int_delta <- data2$Int-data2$Int_lag

data2$Int_delta_forward <- data2$int_forward-data2$Int


data2 <- data2 %>% group_by(year) %>%

  mutate(Int_win = Winsorize(Int, probs = c(0.01,0.99), na.rm = TRUE)) %>%

  ungroup()


data2 <- data2 %>% group_by(year) %>%

  mutate(Int_delta_win = Winsorize(Int_delta, probs = c(0.01,0.99), na.rm = TRUE)) %>%

  ungroup()


data2 <- data2 %>% group_by(year) %>%
```

```
  mutate(Int_delta_forward_win = Winsorize(Int_delta_forward, probs = c(0.01,0.99), na.rm = TRUE))
%>%
  ungroup()



#R&D#


data2$RD_forward <- data2$`Research and Development Expense
t+1`/data2$assets_less_cash_forward

data2$RD_lag <- data2$`Research and Development Expense t-1`/data2$assets_less_cash_lag


data2$RD_delta <- data2$RD - data2$RD_lag

data2$RD_delta_forward <- data2$RD_forward-data2$RD




data2["RD"][is.na(data2["RD"])] <- 0

data2["RD_forward"][is.na(data2["RD_forward"])] <- 0

data2["RD_lag"][is.na(data2["RD_lag"])] <- 0

data2["RD_delta_forward"][is.na(data2["RD_delta_forward"])] <- 0

data2["RD_delta"][is.na(data2["RD_delta"])] <- 0


data2 <- data2 %>% group_by(year) %>%
  mutate(RD_delta_forward_win = Winsorize(RD_delta_forward, probs = c(0.01,0.99), na.rm = TRUE))
%>%
  ungroup()


data2 <- data2 %>% group_by(year) %>%
  mutate(RD_delta_win = Winsorize(RD_delta, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()


#Dividends#
```

```
data2$dividends <- data2$`Dividends Common/Ordinary`/data2$assets_less_cash

data2$dividends_forward <- data2$`Dividends Common/Ordinary
t+1`/data2$assets_less_cash_forward

data2$dividends_lag <- data2$`Dividends Common/Ordinary t-1`/data2$assets_less_cash_lag


data2$dividends_delta <- data2$dividends - data2$dividends_lag

data2$dividends_delta_forward <- data2$dividends_forward-data2$dividends


data2["dividends"][is.na(data2["dividends"])] <- 0

data2["dividends_delta"][is.na(data2["dividends_delta"])] <- 0

data2["dividends_delta_forward"][is.na(data2["dividends_delta_forward"])] <- 0


data2 <- data2 %>% group_by(year) %>%

  mutate(dividends_delta_win = Winsorize(dividends_delta, probs = c(0.01,0.99), na.rm = TRUE)) %>%

  ungroup()


data2 <- data2 %>% group_by(year) %>%

  mutate(dividends_delta_forward_win = Winsorize(dividends_delta_forward, probs = c(0.01,0.99),
na.rm = TRUE)) %>%

  ungroup()


data2 <- data2 %>% group_by(year) %>%

  mutate(dividends_win = Winsorize(dividends, probs = c(0.01,0.99), na.rm = TRUE)) %>%

  ungroup()




#Interaction#


data2$esg_cash <- data2$excess_cash*data2$ESG
```

```
#Change in market value#

data2$marketvalue_delta_forward <- data2$marketvalue_forward-data2$marketvalue

data2 <- data2 %>% group_by(year) %>%
  mutate(market_value_delta_forward_win = Winsorize(marketvalue_delta_forward, probs =
c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

##Testing information asymmetry##

data2$asymmetry <- abs(data2$Bid-data2$Ask)

data2 <- data2 %>% group_by(year) %>%
  mutate(asymmetry_win = Winsorize(asymmetry, probs = c(0.01,0.99), na.rm = TRUE)) %>%
  ungroup()

quantilesExcessCash <- quantile(data2$excess_cash_win, probs = seq(0, 1, 0.25), na.rm = TRUE)
aggregate(asymmetry_win ~ cut(asymmetry_win, quantilesExcessCash), data = data2, FUN = mean)

data2 <- data2 %>% group_by(year) %>%
  mutate(insufficient_cash_win = Winsorize(insufficient_cash, probs = c(0.01,0.99), na.rm = TRUE))
%>%
  ungroup()

data2 <- data2 %>% group_by(year) %>%
  mutate(insufficient_cash_abs_win = Winsorize(insufficient_cash_abs, probs = c(0.01,0.99), na.rm =
TRUE)) %>%
```

```
  ungroup()

##Regressions reported in thesis##

#Table 2#

##Cash holdings. Entire sample. Table 2, column 1##

table_2_col_1 <- lm(cash ~ capex_win +
                      CF_from_Operations_win +
                      Foreign_Tax_win +
                      log_age_win +
                      RD_win +
                      sales_growth_win +
                      working_capital_win+
                      firm_size_win + industry_sigma_win + dividend_dummy +
                      year_Dummy,
                    data = data)



summary(table_2_col_1)
coeftest(table_2_col_1, vcov. = vcovHC(table_2_col_1, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)



#Optimal Cash 2006 and onwards. Table 2, column 2#

table_2_col_2 <- lm(cash ~ capex_win +
                      CF_from_Operations_win +
```

```
                  Foreign_Tax_win +
                  log_age_win +
                  RD_win +
                  sales_growth_win +
                  working_capital_win+
                  firm_size_win + industry_sigma_win + dividend_dummy +
                  year_Dummy + industry,
                subset = year > "2005",
                data = data)



summary(table_2_col_2)

coeftest(table_2_col_2, vcov. = vcovHC(table_2_col_2, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)



##Firm value on cash variables#

#Abnormal cash. Table 5 column 1#

table_5_col_1 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                    net_assets_delta_win + net_assets_delta_forward_win +
                    RD_win + RD_delta_win + RD_delta_forward_win +
                    Int_win + Int_delta_win + Int_delta_forward_win +
                    dividends_win + dividends_delta_win + dividends_delta_forward_win +
                    market_value_delta_forward_win +
                    abnormal_cash_win +
```

```
                year_Dummy + industry, data = data2)

summary(table_5_col_1)
coeftest(table_5_col_1, vcov. = vcovHC(table_5_col_1, cluster = "ticker")) %>%
  round(digits = 3)



#Excess cash table 5, column 2#

table_5_col_2 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                                net_assets_delta_win + net_assets_delta_forward_win +
                                RD_win + RD_delta_win + RD_delta_forward_win +
                                Int_win + Int_delta_win + Int_delta_forward_win +
                                dividends_win + dividends_delta_win + dividends_delta_forward_win +
                                market_value_delta_forward_win +
                                excess_cash_win  + industry +
                                year_Dummy, data = data2)

summary(table_5_col_2)
coeftest(table_5_col_2, vcov. = vcovHC(table_5_col_2, cluster = "ticker", type = "HC1")) %>%
  round(digits = 3)



#Insufficient cash. table 5 column 3#

table_5_col_3 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                                net_assets_delta_win + net_assets_delta_forward_win +
```

```
                    RD_win + RD_delta_win + RD_delta_forward_win +
                    Int_win + Int_delta_win + Int_delta_forward_win +
                    dividends_win + dividends_delta_win + dividends_delta_forward_win +
                    market_value_delta_forward_win +
                    insufficient_cash_abs +
                    year_Dummy + industry, data = data2)

summary(table_5_col_3)
coeftest(table_5_col_3, vcov. = vcovHC(table_5_col_3, cluster = "ticker", type = "HC1")) %>%
  round(digits = 3)



#Firm value on ESG. Table 6 column 1#

table_6_col_1 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + ESG +
                      year_Dummy + industry, data = data2)

summary(table_6_col_1)
coeftest(table_6_col_1, vcov. = vcovHC(table_6_col_1, cluster = "ticker", type = "HC1")) %>%
  round(digits = 3)

#Firm value on Abnormal cash and ESG. Table 6 column 2#
data2$abn_cash_abs <- abs(data2$abnormal_cash)

data2$ESG_abn_cash <- data2$ESG*data2$abnormal_cash
```

```
data2$ESG_excess_cash <- data2$ESG*data2$excess_cash
data2$ESG_insufficient_cash <- data2$ESG*data2$insufficient_cash
data2$ESG_insufficient_cash_abs <- data2$ESG*data2$insufficient_cash_abs


table_6_col_2 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + ESG + abnormal_cash_win +
                      year_Dummy + industry, data = data2)

summary(table_6_col_2)
coeftest(table_6_col_2, vcov. = vcovHC(table_6_col_2, cluster = "ticker", type = "HC1")) %>%
  round(digits = 3)

##Firm value on excess cash and ESG. Tabell 6 column 3##

table_6_col_3 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + ESG + excess_cash_win +
                      year_Dummy + industry, data = data2)

summary(table_6_col_3)

coeftest(table_6_col_3, vcov. = vcovHC(table_6_col_3, cluster = "ticker", type = "HC1")) %>%
  round(digits = 3)
```

```
##Firm value on insufficient cash and ESG. Table 6 column 4#

table_6_col_4 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + ESG + insufficient_cash_abs  +
                      year_Dummy + industry, data = data2)

summary(table_6_col_4)
coeftest(table_6_col_4, vcov. = vcovHC(table_6_col_4, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)


##Firm value on Abnormal Cash and ESG including interaction term. Table 7 column 1##

table_7_col_1 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + ESG + abnormal_cash_win + ESG_abn_cash
+
                      year_Dummy + industry, data = data2)

summary(table_7_col_1)
coeftest(table_7_col_1, vcov. = vcovHC(table_7_col_1, cluster = "ticker",
                                       type = "HC1")) %>%
```

```
  round(digits = 3)



##Firm value on excess Cash and ESG including interaction term. Table 7 column 2##

table_7_col_2 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                                net_assets_delta_win + net_assets_delta_forward_win +
                                RD_win + RD_delta_win + RD_delta_forward_win +
                                Int_win + Int_delta_win + Int_delta_forward_win +
                                dividends_win + dividends_delta_win + dividends_delta_forward_win +
                                market_value_delta_forward_win + ESG + excess_cash_win + ESG_excess_cash
+
                                year_Dummy + industry, data = data2)

summary(table_7_col_2)
coeftest(table_7_col_2, vcov. = vcovHC(table_7_col_2, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)

##Firm value on insufficient Cash and ESG including interaction term. Table 7 column 3##

data2$ESG_insufficient_cash_abs <- abs(data2$ESG_insufficient_cash)

table_7_col_3 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                                net_assets_delta_win + net_assets_delta_forward_win +
                                RD_win + RD_delta_win + RD_delta_forward_win +
                                Int_win + Int_delta_win + Int_delta_forward_win +
                                dividends_win + dividends_delta_win + dividends_delta_forward_win +
                                market_value_delta_forward_win + ESG + insufficient_cash_abs_win +
ESG_insufficient_cash_abs +
                                year_Dummy + industry, data = data2)
```

```
summary(table_7_col_3)


bptest(table_7_col_3)
coeftest(table_7_col_3, vcov. = vcovHC(table_7_col_3, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)




##Firm value on excess Cash and ESG including interaction term.
#Years 2020, 2008 and 2007 excluded##
#Reported in appendix#


data_ex_crisis <- subset(data2, year !=2020 & year != 2008 & year != 2007)



Robustness_ESG_exc_cash_thesis <- lm(marketvalue_win ~ ebit_win + ebit_delta_win +
ebit_delta_forward_win +
                                       net_assets_delta_win + net_assets_delta_forward_win +
                                       RD_win + RD_delta_win + RD_delta_forward_win +
                                       Int_win + Int_delta_win + Int_delta_forward_win +
                                       dividends_win + dividends_delta_win + dividends_delta_forward_win +
                                       market_value_delta_forward_win + ESG + excess_cash_win + ESG_excess_cash
+
                                       year_Dummy + industry, data = data_ex_crisis)


summary(Robustness_ESG_exc_cash_thesis)


bptest(Robustness_ESG_exc_cash_thesis)
coeftest(Robustness_ESG_exc_cash_thesis, vcov. = vcovHC(Robustness_ESG_exc_cash_thesis, type =
"HC1", cluster = "ticker")) %>%
  round(digits = 3)
```

##Firm value on excess Cash and ESG including interaction term.

#Years 2020, 2008 and 2007 only##

#Reported in appendix#

```
data_crisis <- subset(data2, year %in% c(2007, 2008, 2020))


Robustness_ESG_exc_cash_thesis_crisis <- lm(marketvalue_win ~ ebit_win + ebit_delta_win +
ebit_delta_forward_win +
                        net_assets_delta_win + net_assets_delta_forward_win +
                        RD_win + RD_delta_win + RD_delta_forward_win +
                        Int_win + Int_delta_win + Int_delta_forward_win +
                        dividends_win + dividends_delta_win + dividends_delta_forward_win +
                        market_value_delta_forward_win + ESG + excess_cash_win + ESG_excess_cash
+
                        + industry, data = data_crisis)


summary(Robustness_ESG_exc_cash_thesis_crisis)


bptest(Robustness_ESG_exc_cash_thesis_crisis)

coeftest(Robustness_ESG_exc_cash_thesis_crisis, vcov. = vcovHC(Robustness_ESG_exc_cash_thesis,
type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)
```

##Sharholder score partitioning##

##Shareholder score with new weighted governance pillar##

#When reporting this one in thesis, we switch the different measures of ESG each time we run it

##as well as adjusting the above/below median sign##

```
data2$new_governance_pillar <- data2$`CSR strategy score`*0.1688 + data2$`Management score`*0.8312

data2$log_new_governance_pillar <- log(data2$new_governance_pillar)


data2$ESG_new_weights <- log(data2$`Environmental Pillar score`*0.44 + data2$`Social Pillar Score`*0.31 +

  data2$new_governance_pillar*0.25)


data2$cash_new_ESG <- data2$excess_cash*data2$ESG_new_weights




interaction_sh_score_reg <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +

                                 net_assets_delta_win + net_assets_delta_forward_win +

                                 RD_win + RD_delta_win + RD_delta_forward_win +

                                 Int_win + Int_delta_win + Int_delta_forward_win +

                                 dividends_win + dividends_delta_win + dividends_delta_forward_win +

                                 market_value_delta_forward_win + ESG + excess_cash_win + ESG_excess_cash +

                                                 year_Dummy + industry, data = data2,

                               subset = sh_score <= quantile(sh_score, 0.50, na.rm = TRUE))


summary(interaction_sh_score_reg)


bptest(interaction_sh_score_reg)

coeftest(interaction_sh_score_reg, vcov. = vcovHC(interaction_sh_score_reg, type = "HC1", cluster = "ticker")) %>%

  round(digits = 3)



##E, S and G models##


#Environmental. Table 9 column 1#
```

```
data2$excess_cash_environment <- data2$log_environmental*data2$excess_cash

table_9_col_1 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + log_environmental + excess_cash_win +
excess_cash_environment +
                      year_Dummy + industry, data = data2)


summary(table_9_col_1)

coeftest(table_9_col_1, vcov. = vcovHC(table_9_col_1, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)


#Social. Table 9, column 2#

data2$excess_cash_social <- data2$log_social*data2$excess_cash

table_9_col_2 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
```

```
                    net_assets_delta_win + net_assets_delta_forward_win +
                    RD_win + RD_delta_win + RD_delta_forward_win +
                    Int_win + Int_delta_win + Int_delta_forward_win +
                    dividends_win + dividends_delta_win + dividends_delta_forward_win +
                    market_value_delta_forward_win + log_social + excess_cash_win +
excess_cash_social +
                    year_Dummy + industry, data = data2)


summary(table_9_col_2)

coeftest(table_9_col_2, vcov. = vcovHC(table_9_col_2, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)



#Governance. Table 9 column 3#

data2$excess_cash_governance <- data2$log_governance*data2$excess_cash

table_9_col_3 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + log_governance + excess_cash_win +
excess_cash_governance +
                      year_Dummy + industry, data = data2)


summary(table_9_col_3)
```

```
coeftest(table_9_col_3, vcov. = vcovHC(table_9_col_3, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)



#ESG net of shareholder score table 9 colum 4#


data2$new_governance_pillar <- data2$`CSR strategy score`*0.1688 + data2$`Management
score`*0.8312
data2$log_new_governance_pillar <- log(data2$new_governance_pillar)


data2$ESG_new_weights <- log(data2$`Environmental Pillar score`*0.44 + data2$`Social Pillar
Score`*0.31 +
                       data2$new_governance_pillar*0.25)


data2$cash_new_ESG <- data2$excess_cash*data2$ESG_new_weights


table_9_col_4 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + ESG_new_weights + excess_cash_win +
cash_new_ESG +
                      year_Dummy + industry, data = data2)



summary(table_9_col_4)


coeftest(table_9_col_4, vcov. = vcovHC(table_9_col_4, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)
```

#Table 10#

#ESG high SH_score. Table 10 column 1#

```
table_10_col_1 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                     net_assets_delta_win + net_assets_delta_forward_win +
                     RD_win + RD_delta_win + RD_delta_forward_win +
                     Int_win + Int_delta_win + Int_delta_forward_win +
                     dividends_win + dividends_delta_win + dividends_delta_forward_win +
                     market_value_delta_forward_win + ESG + excess_cash_win + ESG_excess_cash +
                     year_Dummy + industry, data = data2,
                    subset = sh_score > quantile(sh_score, 0.50, na.rm = TRUE))



summary(table_10_col_1)

coeftest(table_10_col_1, vcov. = vcovHC(table_10_col_1, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)
```

#ESG low SH_score. Table 10 column 2#

```
table_10_col_2 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                      net_assets_delta_win + net_assets_delta_forward_win +
                      RD_win + RD_delta_win + RD_delta_forward_win +
                      Int_win + Int_delta_win + Int_delta_forward_win +
                      dividends_win + dividends_delta_win + dividends_delta_forward_win +
                      market_value_delta_forward_win + ESG + excess_cash_win + ESG_excess_cash +
                      year_Dummy + industry, data = data2,
```

```
                subset = sh_score <= quantile(sh_score, 0.50, na.rm = TRUE))


summary(table_10_col_2)

coeftest(table_10_col_2, vcov. = vcovHC(table_10_col_2, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)


#new ESG high SH_score. Table 10 column 3#

table_10_col_3 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
                     net_assets_delta_win + net_assets_delta_forward_win +
                     RD_win + RD_delta_win + RD_delta_forward_win +
                     Int_win + Int_delta_win + Int_delta_forward_win +
                     dividends_win + dividends_delta_win + dividends_delta_forward_win +
                     market_value_delta_forward_win + ESG_new_weights + excess_cash_win +
cash_new_ESG +
                     year_Dummy + industry, data = data2,
                    subset = sh_score > quantile(sh_score, 0.50, na.rm = TRUE))


summary(table_10_col_3)

coeftest(table_10_col_3, vcov. = vcovHC(table_10_col_3, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)


#new ESG low SH_score. Table 10 column 3#

table_10_col_4 <- lm(marketvalue_win ~ ebit_win + ebit_delta_win + ebit_delta_forward_win +
```

```
                net_assets_delta_win + net_assets_delta_forward_win +
                RD_win + RD_delta_win + RD_delta_forward_win +
                Int_win + Int_delta_win + Int_delta_forward_win +
                dividends_win + dividends_delta_win + dividends_delta_forward_win +
                market_value_delta_forward_win + ESG_new_weights + excess_cash_win +
cash_new_ESG +
                year_Dummy + industry, data = data2,
               subset = sh_score <= quantile(sh_score, 0.50, na.rm = TRUE))



summary(table_10_col_4)


coeftest(table_10_col_4, vcov. = vcovHC(table_10_col_4, type = "HC1", cluster = "ticker")) %>%
  round(digits = 3)







##Running above and below median shareholder score##


data2$log_environmental[is.na(data2$log_environmental)] <- 0
data2$log_social[is.na(data2$log_social)] <- 0







##Testing SG&A on different pillars as Lins et.al when estimating costs of CSR##
```

```
data2$log_SGA <- log(data2$`Selling, General and Administrative Expense`- data2$`Advertising Expense`)

data2$log_SGA[is.nan(data2$log_SGA)] <- NA


data2$log_assets <- log(data2$`Assets - Total`)

data2$cash_to_assets <- data2$`Cash and Short-Term Investments`/data2$`Assets - Total`

data2$debt_to_assets <- (data2$`Debt in Current Liabilities - Total`+data2$`Long-Term Debt - Total`)/

  data2$`Assets - Total`


data2$dividends_to_assets <- data2$`Dividends Common/Ordinary`/data2$`Assets - Total`


data2$income_before_extraordinary <- data2$`Operating Income Before Depreciation`/data2$`Assets - Total`


data2$btm <- data2$`Book/Market`


ESG_cost_reg <- lm(log_SGA ~ log_social + log_environmental  + log_assets + btm + cash_to_assets + debt_to_assets +

                     dividends_to_assets + income_before_extraordinary + industry + year_Dummy,

                   data = data2)


summary(ESG_cost_reg)


coeftest(ESG_cost_reg, vcov. = vcovHC(ESG_cost_reg, type = "HC1", cluster = "ticker")) %>%

  round(digits = 3)
```