

Bloomberg, Big Data, Microstructure, & HPC

ACE 592SAE

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Bloomberg Terminal

Introduction

- Bloomberg Terminal is a professional financial data provider, which covers equity, commodity, FX, interest rates, etc.
- Traders could monitor real-time market, and also obtain huge volume of news, reports, and forecasts.
- Financial researchers could retrieve historical financial market data, for academic research or back-testing.
- Three Bloomberg machines in ACE: Two in Lab, one in 336 OFOR Data Room.
 - Real-time monitoring in commodity markets
 - Historical data extraction
 - Professional desktop subscription
 - Not Bloomberg Anywhere account
 - No remote access available

Bloomberg Terminal



Bloomberg Terminal

Login

The image shows the initial login screen of the Bloomberg Terminal. At the top left is the Bloomberg logo with the text '<Enter> or <GO> to begin'. In the center, there is a large text area for selecting a language. Below this, a message encourages users to customize their news language experience by typing 'LANG <GO>' after login. At the bottom, there is a 'Contact Us' link and some system information. A footer at the very bottom contains standard navigation icons.

Select Language for Analytics and Communication Functions:

▼ English	Español	한국어
日本語	Português	简体中文
Français	Italiano	Русский
Deutsch	繁體中文	

To customize your News language experience
type LANG <GO> after login.

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Monitoring markets

Exchanges: CME

Price Book

Total	Ord	Size	Bid	Ask	Size	Ord	Total
20	11	3989.25	3989.50	2	9		
20	11	20	3989.25	3989.50	9	2	9
38	13	18	3989.00	3989.75	17	9	26
64	14	26	3988.75	3990.00	36	11	62
92	15	28	3988.50	3990.25	23	12	85
117	13	25	3988.25	3990.50	54	16	139
146	15	29	3988.00	3990.75	29	16	168
183	19	37	3987.75	3991.00	31	13	199
220	16	37	3987.50	3991.25	28	14	227
252	16	32	3987.25	3991.50	28	14	255
287	17	35	3987.00	3991.75	31	17	286
287							
S&P500 EMINI FUT Jun23			Under	Over			286
Vwap 3994.8246			Avg Vol 30 Day 734,490				
Beta			Theo Auct Price 3972.75				
% Change +.48%			Theo Auct Vol 0				

Average Buy/Sell Price

Buy	Amount	0
Sell	Remaining	0
Avg Price 3989.5000		

Trade Recap | QR »

Time	Size	Price
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:11	1	3989.50
15:47:10	1	3989.50
15:47:10	4	3989.50
15:47:10	1	3989.50
15:47:10	1	3989.50
15:47:10	1	3989.50
15:47:10	7	3989.50
15:47:10	7	3989.50
15:47:10	7	3989.50
15:47:10	1	3989.50
15:47:10	4	3989.50
15:47:10	1	3989.50
15:47:10	7	3989.50
15:47:10	7	3989.50
15:47:10	2	3989.50

Bloomberg Terminal

Bloomberg Intelligence

Skip to Content | Search

■ Bloomberg Intelligence +

CANCEL HELP SEARCH NEW! CHARTS QUOTE MSG MENU PRINT PDF B4 PDF P4

< > S&P500 EMINI FUT Jun23 Index ▾ B1 ▾ Related Functions Menu ▾

Back> To Return, 94 <G0> to Hide Navigation

Action ▾ Directory Export Settings

Search (I) Research and Data

Agricultural Chemicals Dashboard (BT AGCHG) Global

research Macro Ag Supply/Demand MASDE Farm Economics Ag Cost FX

Dashboard Ho... View 1 Months

Name: **BT AGCHG** **USDA Predicted** **Consensus Expectations** **USDA Estimated** **USDA Actual**

Expand "Survey" for more details

U.S. CORN

Projected Production - Surprise (%) **W** 13,730.0 13,730.0 13,730.0 13,930.0 13,930.0 13,955.0 13,944.0 14,359.0 14,505.0 14,460.0 14,460.0 15,115.0

Release (mn bushels)

• Survey - Median (mn bushels) **W** 13,935.5 13,899.0 13,955.0 14,080.0 14,400.0 14,503.0 14,460.0 14,803.0

Projected Ending Stock- Surprise (%) **W** 3.15 -0.63 -5.37 2.03 -2.72 5.59 1.67 -2.60 1.38 2.94 5.22 2.86

Release (mn bushels) **W** 1,342.0 1,267.0 1,242.0 1,257.0 1,182.0 1,172.0 1,219.0 1,388.0 1,470.0 1,400.0 1,360.0 1,440.0

• Survey - Median (mn bushels) **W** 1,301.0 1,275.0 1,312.5 1,232.0 1,215.0 1,110.0 1,199.0 1,425.0 1,450.0 1,360.0 1,292.5 1,400.0

U.S. SOYBEAN

Projected Production - Surprise (%) **W** 4,276.0 4,276.0 4,276.0 4,346.0 4,346.0 4,346.0 4,313.0 4,378.0 4,531.0 4,505.0 4,640.0 4,640.0 4,435.0

Release (mn bushels)

• Survey - Median (mn bushels) **W** 4,258.0 4,313.0 4,378.0 4,511.0 4,485.0 4,500.0 4,640.0 4,635.0

Projected Ending Stock- Surprise (%) **W** -6.67 7.14 -10.64 -2.65 4.76 -17.01 -18.37 10.36 13.58 -5.08 -1.27 -3.70

Release (mn bushels) **W** 210.0 225.0 210.0 220.0 220.0 200.0 200.0 245.0 230.0 280.0 310.0 260.0

• Survey - Median (mn bushels) **W** 225.0 210.0 235.0 226.0 210.0 241.0 245.0 222.0 202.5 295.0 314.0 270.0

U.S. MHEAT

Projected Production - Surprise (%) **W** 1,650.0 1,650.0 1,650.0 1,650.0 1,650.0 1,650.0 1,783.0 1,783.0 1,781.0 1,737.0 1,729.0 1,646.0

Release (mn bushels)

• Survey - Median (mn bushels) **W** 1,650.0 1,783.0 1,781.0 1,737.0 1,729.0 1,646.0

Projected Ending Stock- Surprise (%) **W** 0.00 -0.35 -2.24 -1.55 -0.87 2.86 0.00 -1.15 0.31 1.29 9.24 3.83

Release (mn bushels) **W** 568.0 568.0 567.0 571.0 571.0 576.0 610.0 610.0 639.0 627.0 619.0 678.0

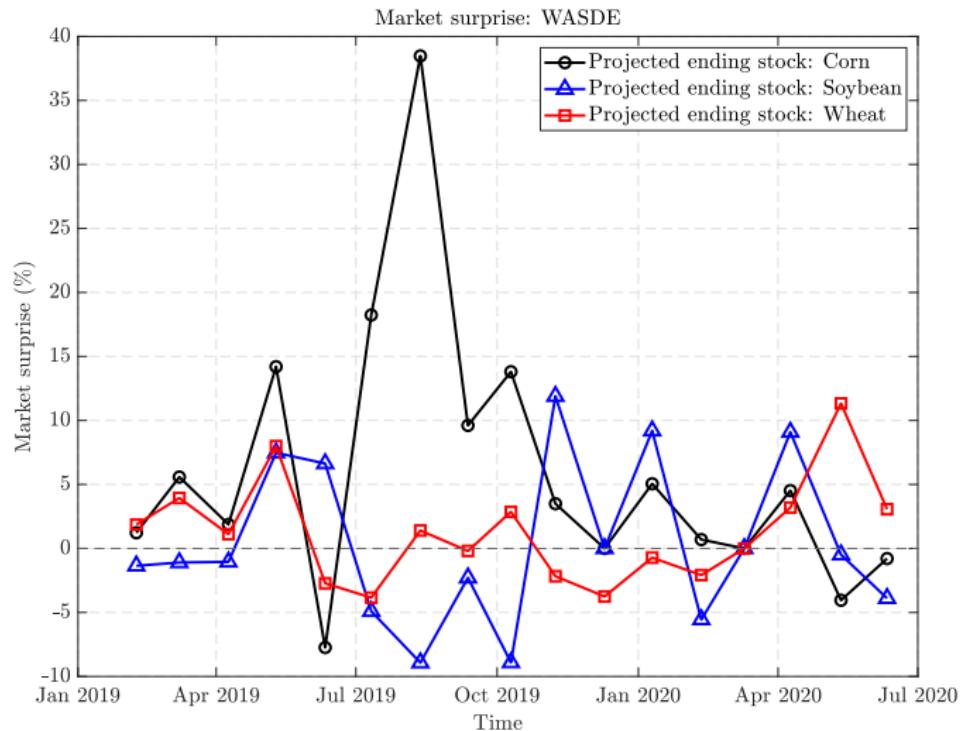
• Survey - Median (mn bushels) **W** 568.0 570.0 580.0 580.0 576.0 560.0 610.0 650.0 641.0 619.0 682.0 653.0

Notes Available Additional Info How to Use This Page | NSN ▾ Crop Calendar | MMDL ▾

Suggested Functions BIO Find a person in the Bloomberg community

Bloomberg Terminal

Bloomberg Intelligence



Bloomberg Terminal

Retrieving data from R API

- You need to get a Bloomberg Terminal (free) account and log in before retrieving data.
- Install `Rblpapi` package in R.
- Figure out the security ticker that you need. E.g., If I want to retrieve historical data of CME corn May 2020 contract, I need to know its ticker is 'C K20 Comdty' in Bloomberg (Tickers can also be found through Excel Add-in).
- Figure out what data fields you need. E.g., If I want to retrieve historical trading volume data, I need to know its field is 'PX_VOLUME'. (You could find fields in Excel Add-in)
- You may frequently use `bdh` function to retrieve Bloomberg Data History queries.
- Currently, our Bloomberg Terminal supports all daily data of almost financial instruments, while intraday data can be supported at most 1 month based on sampling frequency.
 - Direct data feed from exchanges are not supported.

Bloomberg Terminal

R API example

```
1 install.packages("Rblpapi")
2 install.packages("data.table")
3 library(Rblpapi)
4 library(data.table)
5
6 ## connect to the Bloomberg Terminal
7
8 con <- blpConnect()
9
10 ## Retrieve the historical daily trade volume of CME wheat March 2021 contract.
11
12 volume <- bdh('C H21 Comdty', c("PX_VOLUME"), start.date = as.Date("2021-01-03"), end.
13   date = as.Date("2021-03-01"), include.non.trading.days = FALSE)
14
15 ## Another example
16 code <- c("W H19 Comdty", "W K19 Comdty", "W N19 Comdty", "W U19 Comdty", "W Z19 Comdty",
17   "W H20 Comdty", "W K20 Comdty", "W N20 Comdty", "W U20 Comdty", "W Z20 Comdty")
18
19 volume <- list()
20
21 for (i in 1:length(code)) {
22
23   volume[[i]] <- bdh(code[i], c("PX_VOLUME", "PX_SETTLE"), start.date = as.Date
24     ("2019-01-03"), end.date = as.Date("2019-12-31"), include.non.trading.days = FALSE)
25 }
```

Microstructure & Big Data

Introduction

- Microstructure is a field that focuses on how market efficiency can be achieved and how to enhance market efficiency.
 - Neoclassical economics assumes market is clearing and there is no transaction cost. But in reality, we surely face transaction costs.
 - How to define transaction costs and how to measure transaction costs in trading.
 - How different market participants interact with each other? (e.g., market makers, informed traders, uninformed traders)
- Electronic trading with central limit order book (around 1990s) opens a new door to microstructure research.
 - Traders can react to market really soon and manage their trading tasks more effectively (e.g., fast order update to the fundamental).
 - However, negative externality also happens. (e.g., high volatility, adverse selection, etc.)

Microstructure & Big Data



Pit trading

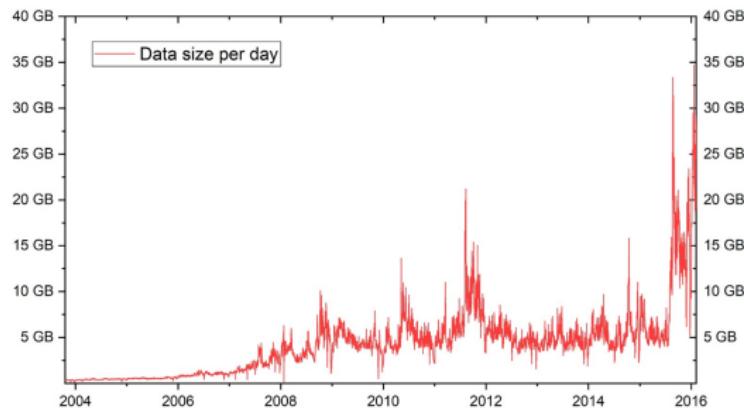


Electronic trading

Microstructure & Big Data

High-frequency trading

- Since around 2010, HFT has been popular in almost all financial markets.
 - Ultra fast speed: Market could move at microsecond level
 - Sophisticated trading algorithms: What to trade (human) v.s. How to trade (machine).
 - Data driven environment: Tremendous trading messages every day.



Source: Ye, Mao. 2018. NBER Seminar “Big Data and High-Performance Computing for Financial Economics”.

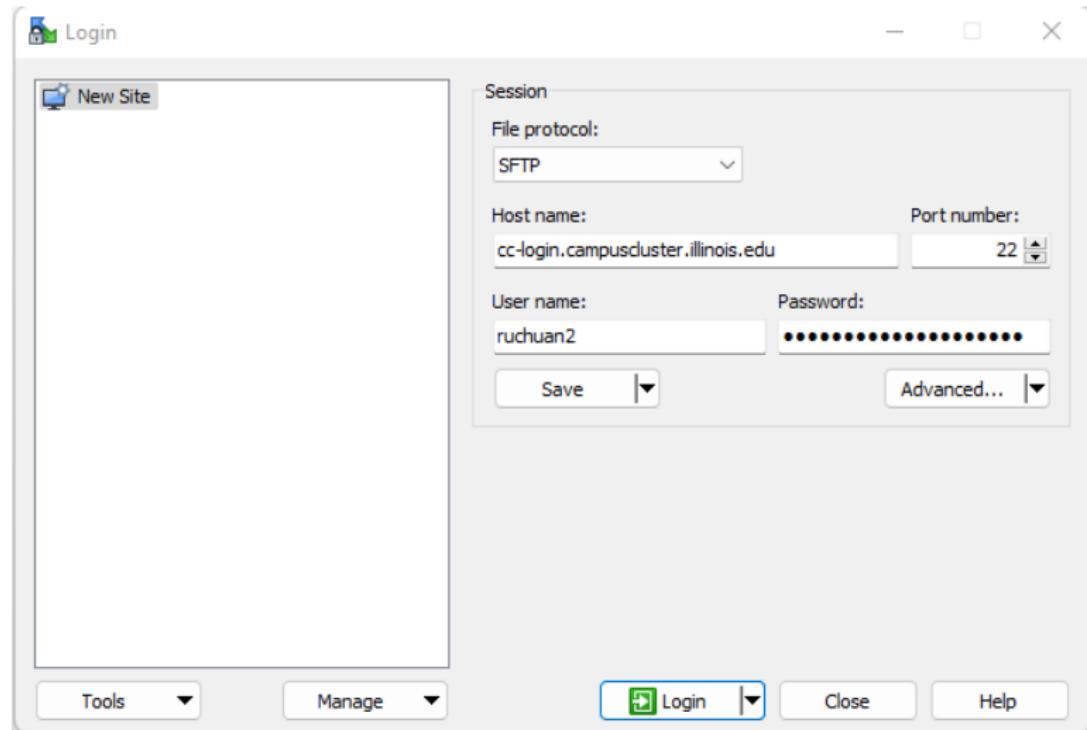
Microstructure & Big Data

My big data experience

- Reconstruct limit order book with CME Market Depth data.
 - Raw message data → Tabulated message data → Limit order book.
 - There are more than 200,000 messages every day in a single market.
 - The limit order book needs to be reconstructed week by week.
 - I need to consider how to deal different messages (e.g., submission, modification, cancellation). Sometimes, the fixed limit order book should be moved forward or back.
 - Finally, the consolidated limit book is needed by aggregating implied limit order book and outright limit order book. Sometimes, moving is also needed.
- I have also used the campus cluster to run my R codes.
 - Easy to use and manage. No need to learn really complicated Unix.
 - A good choice for programming that needs large memory.

Microstructure & Big Data

Campus Cluster



Microstructure & Big Data

Campus Cluster

```
#!/projects/aces/ruchuan2/corn/message1/Corn_LOB_conso_update_parallel.R - ruchuan2@cc-login.campuscluster.illinois.edu - Editor - WinSCP

library(data.table)
library(foreach)
library(doMC)

registerDoMC(56)

file_list <- list.files('/projects/aces/ruchuan2/corn/message1/', pattern = "xcbt_", recursive = TRUE)
contract_LOB_folder <- unique(substr(file_list, 1, 4))

PARALLEL <- foreach(i=1:length(contract_LOB_folder), .packages = c("data.table")) %dopar% {

  contract_all <- subset(file_list, substr(file_list,1,4)==contract_LOB_folder[i])
  week_seq <- unique(substr(contract_all,32,36))

  week_seq_finished <- unique(substr(list.files(path = paste0("/projects/aces/ruchuan2/corn/conso_LOB/", contract_LOB_folder[i])), 32, 36))

  week_seq1 <- week_seq[which(week_seq %in% week_seq_finished==FALSE)]

  if(length(week_seq1)>0){

    for (j in 1:length(week_seq1)){
      LOB_week <- paste0(substr(contract_all, substr(contract_all,32, 36)==week_seq1[j]))

      message_all <- list()

      for (l in 1:length(LOB_week)) {
        message_all[[l]] <- load(LOB_week[l])
        message_all[[l]] <- unique(message_sf)
      }

      message_all <- rbindlist(message_all,use.names = TRUE)
      message_all <- unique(message_all)
      #load("C:/Users/ruchuan2/OneDrive - University of Illinois - Urbana/Corn_message/test.rda")

      #setnames(message_all, c("n_order"), c("Ord")) ## corn futures only

      ## identify the implied orders as K
      if(as.Date(message_all$date[1], "%Y-%m-%d") >= "2015-11-20"){

        message_all$message_all$bidask=="E"|message_all$bidask=="F", "RK"] <- "K"
        message_all$message_all$bidask==0|message_all$bidask==1, "RK"] <- "R"
      }

      date <- unique(message_all$date)
      rm(message_sf)

      print(LOB_week[1])
    }
  }
}

Line 16/1231 Column 1 Encoding: 1252 (ANSI - Le
```

Tips

- Learning by doing. It'd better learn coding with a specific project.
- Trying to code efficiently. There are really good packages in R, e.g., `dplyr`, `data.table`, `tidyverse`, etc.
- It is a long-term learning process. Patience is needed.
- Using Stack Overflow when you have some coding problems.
- GOOD LUCK!